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Skeptical Inquirer

THE MAGAZINE FOR SCIENCE AND REASON

Vol. 38 No. 3 | May/June 2014

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BILL NYE on His Creationist Debate

UFOs and Cognitive Science

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Outrageous Misuses of Quantum Physics

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Quantum Mystification

It is hardly surprising that quantum mechanics (QM) is so counterintuitive. As Stanford theoretical physicist Leonard Susskind points out in a new book on the subject, quantum mechanics describes effects so small that they are completely beyond the range of the human senses. "So it stands to reason that we did not develop an intuition for the quantum world."

QM nevertheless sparked a twentieth-century intellectual revolution, and to physicists it has long been considered commonplace, if strange. Experiments, after all, repeatedly verify its validity. The unusual aspects of quantum mechanics in the micro world have opened the gate for countless misinterpretations by nonscientists who misapply it to the macro world, the world of our own experience.

In "Stop Heisenberg Abuse!" in this issue, physics and calculus teacher Dale DeBakcsy elegantly explores three instances of "outrageous misappropriations of quantum physics." (There are at least ten more.) "No rules! Down with Newton!" seems to be the thinking, he notes. Yet quantum mechanics, far from being a channel to the world of subjectivity and cultural relativism so beloved by many outside of science, operates by exact rules. Disregarding them leads to a number of "big lies" about QM. DeBakcsy examines these three (all widely believed):

Lie One: "Quantum physics says that mind determines reality. . . ." *Lie Two:* "Quantum entanglement means that precognition and telekinesis probably exist." *Lie Three:* "Heisenberg's Uncertainty principle means that science has failed in its fundamental goal of explaining reality, and we should therefore open ourselves up to alternative reality-explaining language games, such as are offered by religion."

DeBakcsy clearly explains why each of these arguments is mistaken.

"I adore quantum physics," he writes. "What I can't stand is misappropriating a handful of sexy-sounding terms and then applying them metaphorically to add scientific heft to one's particular intellectual fetish." DeBakcsy has a nice way with words as he explains these misunderstandings. He demystifies what many prefer to mystify.

We also offer two different but pleasingly complementary articles about UFO reports. One, a fifth SI collaboration of James McGaha and Joe Nickell, examines the role Mount Rainier has played in generating UFO sightings over the past century-plus; the other, by psychology professor Matthew J. Sharps, draws on insights of cognitive science to show how scientifically explainable phenomena get converted, in the minds of witnesses, into nonexistent entities such as extraterrestrial spacecraft and their alien pilots.

* * *

We normally don't preview our next issue in this space. This time I make an exception. Our July/August 2014 edition will be a special issue on Science & Religion. We have done occasional Science & Religion issues in the past, and all have been well received, but this will be our first since 2007.

—Kendrick Frazier

Committee for Skeptical Inquiry
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The Skeptical Inquirer is the official journal of the Committee for Skeptical Inquiry, an international organization.

The Skeptical Inquirer (ISSN 0194-6730) is published bimonthly by the Committee for Skeptical Inquiry, 3965 Rensch Road, Amherst, NY 14228. Printed in U.S.A. Periodicals postage paid at Buffalo, NY, and at additional mailing offices. Subscription prices: one year (six issues), $35; two years, $60; three years, $84; single issue, $4.95. Canadian and foreign orders: Payment in U.S. funds drawn on a U.S. bank must accompany orders; please add US$10 per year for shipping. Canadian and foreign customers are encouraged to use Visa or MasterCard. Canada Publications Mail Agreement No. 41153509. Return undeliverable Canadian addresses to: IMEX, P.O. Box 4332, Station Rd., Toronto, ON M5W 3J4.

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Science Indicators 2014: Science Knowledge Stable, Astrology Belief Rises . . . But That's Not All

Kendrick Frazier

National media coverage of the 2014 *Science Indicators* report issued in February centered mostly on two points: one out of four Americans don't know the Earth goes around the sun, and attitudes toward astrology have become more favorable.

But in fact, the performance on the sun-Earth question remains essentially unchanged from previous years, and Americans' performance on the question was better than that of Europeans and of residents of India (but not as good as in South Korea).

The astrology question did seem to indicate something new, but whether this is the reversal of a three-decade trend of a generally more critical attitude toward astrology will have to await 2016's report.

The media focus on just those two questions masks the range and depth of important information in the report, which is prepared every two years by the U.S. National Science Foundation's National Center for Science and Engineering Statistics on behalf of the National Science Board, NSF's policy-making body.

The central conclusion of the overall report is that the United States' lead in science and technology is shrinking. Europe's share of the world's research and development is going down as well, as Asian countries are coming more to the fore. Since 2001, the United States' share of the world's R&D has decreased from 37 percent to 30 percent. Europe's share has decreased from 26 percent to 20 percent. Asian countries' share grew from 25 percent to 34 percent, led by China, whose share exploded from just 4 percent in 2001 to 15 percent now.

But for people concerned about the place of science in society, and for scientists and science-minded skeptics concerned about public understanding and misunderstandings of science, the report is, as always, a goldmine. For these audiences the key part is Chapter 7, on public attitudes and understanding of science and technology. The report incorporates and reviews a wide range of recent high-quality survey data from the U.S. and, for comparison, from international sources.

Americans continue to hold leaders in both the scientific and medical communities in high regard, higher than any occupation other than the military. Most other countries likewise regard scientists and medical people highly. Four out of five Americans say they are interested in new scientific discoveries, a somewhat higher proportion than in Europe.

Concerning public knowledge, Americans correctly answered 5.9 out of nine factual knowledge questions in 2012. This score is very similar to that of most recent years (Figure 7-7 on next page). One of the questions indeed was "Does the Earth go around the sun, or does the sun go around the Earth?" Seventy-four percent of Americans answered correctly (Earth goes around the sun), meaning 26 percent did not. But notice (Table 7–8 at left) that only 66 percent of European Union residents answered the question correctly. Seventy percent of Indians did, 72 percent of Malaysians, and 84 percent of South Koreans. This score is very similar to that of most recent years.

I have a copy of the 2000 *Science Indicators* report, based on 1999 data. More than 70 percent of Americans answered the question correctly then as

Table 7-8
Correct answers to factual knowledge questions in physical and biological sciences, by country/region: Most recent year
(Percent giving correct answer)

Question	United States[a] (2012)	China (2010)	EU (2005)	India (2004)	Japan (2011)	Malaysia (2008)	Russia (2003)	South Korea (2004)
Physical science								
The center of the Earth is very hot. (True)	84	56	86	57	84	66	NA	87
The continents have been moving their location for millions of years and will continue to move. (True)	83	50	87	32	88	44	40	87
Does the Earth go around the Sun, or does the Sun go around the Earth? (Earth around Sun)	74	NA	66	70	NA	72	NA	86
All radioactivity is man-made. (False)	72	48	59	NA	69	14	35	48
Electrons are smaller than atoms. (True)	53	27	46	30	32	33	44	46
Lasers work by focusing sound waves. (False)	47	23	47	NA	32	16	24	31
The universe began with a huge explosion. (True)	39	NA	NA	34	NA	NA	35	67
Biological science								
It is the father's gene that decides whether the baby is a boy or a girl.[b] (True)	63	58	64	38	29	40	22	59
Antibiotics kill viruses as well as bacteria.[c] (False)	51	28	46	39	33	8	18	30
Human beings, as we know them today, developed from earlier species of animals. (True)	48	66	70	56	76	NA	44	64

NA = not available, question not asked.

EU = European Union; data are not available for Bulgaria and Romania.

[a] See appendix table 7-9 for U.S. trends.
[b] China and Europe surveys asked about "mother's gene" instead of "father's gene."
[c] Japan survey asked about "antibodies" instead of "antibiotics."

SOURCES: United States—University of Chicago, National Opinion Research Center, General Social Survey (2012); China—Chinese Association for Science and Technology/China Research Institute for Science Popularization, Chinese National Survey of Public Scientific Literacy (2010); EU—European Commission, Eurobarometer 224/Wave 63.1: Europeans, Science and Technology (2005), and Eurobarometer 224/Wave 64.3: Europeans and Biotechnology in 2005: Patterns and Trends (2006); India—National Council of Applied Economic Research, National Science Survey (2004); Japan—National Institute of Science and Technology Policy/Ministry of Education, Culture, Sports, Science and Technology, Survey of Public Attitudes Toward and Understanding of Science and Technology in Japan (2011); Malaysia—Malaysian Science and Technology Information Centre/Ministry of Science, Technology and Innovation, Survey of the Public's Awareness of Science and Technology: Malaysia (2008); Russia—Gokhberg L, Shuvalova O, Russian Public Opinion of the Knowledge Economy: Science, Innovation, Information Technology and Education as Drivers of Economic Growth and Quality of Life, British Council, Russia (2004); South Korea—Korea Science Foundation (now Korea Foundation for the Advancement of Science and Creativity), Survey of Public Attitudes Toward and Understanding of Science and Technology (2004).

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Of course where Americans *do* rate poorly in comparison with people in other countries is on two questions that raise resistance on religious grounds. Only 39 percent of Americans said it was true that the universe began with a huge explosion, in comparison with, for example, 67 percent of South Koreans. But the real resistance is to the question about human evolution.

well. However, then there was a related question on which Americans didn't do so well: "The Earth goes around the sun once a year." Less than fifty percent of Americans answered that one correctly ("true").

Perhaps more telling is that in the new report only 53 percent of Americans answered correctly that electrons are smaller than atoms. This seems a fundamental bit of scientific knowledge. But China, Europe, India, Japan, and South Korea fared even worse. And the Americans' score is better than the 46 percent of Americans who answered that question correctly in 1999.

In general, worldwide, despite country-by-country variations by specific questions, "no country consistently outscores the others," says the new report. In Europe, the northern countries do better, led by Sweden, which scored the highest on a set of thirteen questions.

Of course where Americans *do* rate poorly in comparison with people in other countries is on two questions that raise resistance on religious grounds. Only 39 percent of Americans said it was true that the universe began with a huge explosion, in comparison with, for example, 67 percent of South Koreans. But the real resistance is to the question about human evolution. Only 48 percent of Americans said it was true that "Human beings, as we know them today, developed from earlier species of animals." In comparison 76 percent of Japanese, 70 percent of Europeans, and 66 percent of Chinese answered "true." This confirms the long history of many Americans' resistance to the idea that we have evolved.

But this year's study did something new and very interesting. A General Social Survey (GSS) experiment asked the same two questions but, for half of the respondents (randomly chosen), added a preface framing the statement as a scientific idea. The survey researchers decided to do this because "Americans' responses [to these two questions] appear to reflect factors beyond unfamiliarity with the basic elements of science." That's a way of saying answers are affected by prior beliefs that have little to do with the scientific evidence.

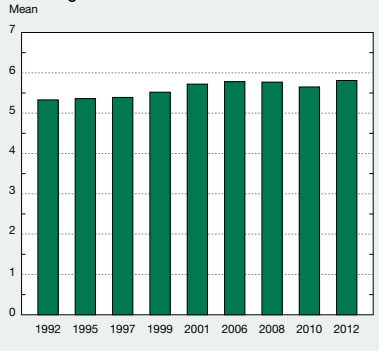
So for the evolution question, the second version prefaced it with the phrase, "According to the theory of evolution . . ." When that preface appeared in the question, the number saying it was true that humans evolved from earlier species rose to 72 percent. This is an enormous improvement of 24 percentage points.

For the big bang question, the preface for the second version was, "According to astronomers…" When the question was asked that way, the percentage answering that it was true the universe began in a big explosion rose to 60 percent. This was an improvement of 21 percentage points.

So framing these two potentially contentious questions as scientific ideas elicits far greater support than otherwise, a very interesting circumstance.

One measure of public understanding of science is the public's capacity to distinguish science from pseudoscience. Since 1979, the *Science Indicators* reports have included a question about

Figure 7-6
Mean number of correct answers to trend factual knowledge of science scale: 1992–2012



NOTES: Mean number of correct answers to the nine questions that are included in the trend factual knowledge of science scale; see appendix table 7-8 for explanation, list of questions, and percentage of questions answered correctly. See appendix tables 7-9 and 7-10 for responses to individual questions.

SOURCES: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Public Attitudes Toward and Understanding of Science and Technology (1992–2001); University of Chicago, National Opinion Research Center, General Social Survey (2006–12).

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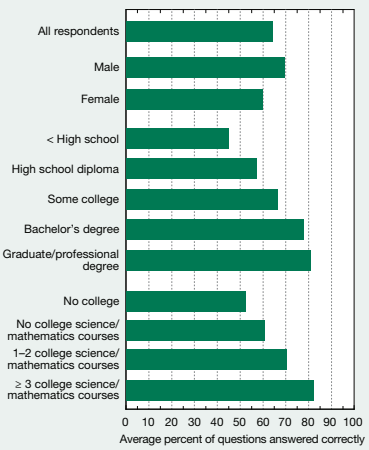
Figure 7-7
Correct answers to trend factual knowledge of science scale, by respondent characteristic: 2012



NOTES: Data reflect the average percentage of nine questions answered correctly. "Don't know" responses and refusals to respond are counted as incorrect. See appendix table 7-8 for explanation, list of questions, and additional respondent characteristics. See appendix tables 7-9 and 7-10 for responses to individual questions.

SOURCE: University of Chicago, National Opinion Research Center, General Social Survey (2012).

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astrology as a representative pseudoscience. This year's results indeed seem troubling. The question is: "Do you regard astrology as 'scientific,' 'sort of scientific,' or 'not at all scientific'?" In 2010, 62 percent of Americans answered that astrology was not scientific; in 2004, 66 percent. But this year just 55 percent—only a little over half—said astrology was not scientific. One third (32 percent) said they thought astrology was "sort of scientific," and 10 percent said it was "very scientific."

The report expresses concerns: "The only years when a smaller percentage of respondents said that astrology was not at all scientific was in 1979, when 50% gave that response, and in 1983, when 51% gave that response."

Those with more education and higher incomes were less likely to rate astrology as scientific, but the breakdown by ages was a cause for concern. Younger respondents were the most likely to regard astrology as scientific, with only 42 percent of the youngest age group (18–34) saying that astrology is "not at all scientific." But the 35–44 age group had the greatest change; in 2010, 64 percent of respondents in this age group said that astrology was not scientific; in 2012, that percentage dropped to 51 percent.

The astrology answer stimulated much subsequent discussion. One psychologist contended that people were merely confusing the words *astrology* and *astronomy*. But others pointed out that the astrology question was preceded by one asking "Did you ever read a horoscope or your personal astrology report?" thus giving appropriate context for the main question. At any rate, even if some people may confuse *astrology* and *astronomy*, that wouldn't explain why they'd be more confused about the meaning of the words in 2012 than in previous years.

Of course the late 1970s and early 1980s were a heyday of acceptance of astrology, something we'd thought had tapered off. Is that changing? Again, we may not know for sure for two more years when the next biennial survey results come out.

The only international comparison on this matter the 2014 report offers is one in China. There a survey about superstition conducted in 2010 gave these results: 80 percent of Chinese respondents did not believe in "fortune-telling sticks," 87 percent did not believe in dream interpretations, and 92 percent did not believe in horoscopes.

Americans' views differ in several other areas from people in other countries, the study shows. On climate change, Americans remain divided and hold views different from those of citizens of other countries; many of those surveyed in other countries "show more concern" than the U.S. does about climate change.

Of course the late 1970s and early 1980s were a heyday of acceptance of astrology, something we'd thought had tapered off. Is that changing?

On the other hand, Americans are less concerned about "modifying the genes of certain crops" than residents of many other countries, and their support for nuclear energy and oil has "rebounded or stabilized" following declines associated with major accidents. Also, most Americans (6 out of 10) see using stem cells from human embryos in medical research as "morally acceptable."

In addition to the questions about scientific knowledge and about pseudoscience, a larger concern is just how well people understand the scientific process itself. *Science Indicators* sought data on three general topics—probability, experimental design, and the scientific method—to elicit trends in Americans' understanding of the process of scientific inquiry.

Sixty-five percent of Americans got both probability questions correct (they had to do with genetically caused disease), but with regard to understanding experiments, only one-third (34 percent) were able to answer a question about how to test a drug, and this percentage was down precipitously from 2010 when 51 percent answered correctly. Only about 20 percent of Americans scored correctly on a question asking them to describe the scientific method (they had to mention at least one of the following: testing a theory using hypotheses, conducting an experiment with a control group, or making rigorous and systematic comparisons). This number was worse than the 27 percent in 2010, although similar to those percentages in other recent years.

So Americans continue to hold science and scientists in high regard and want funding for research. But many have difficulty answering what seem relatively simple questions about scientific knowledge and don't have a lot of understanding about how scientists seek out the truth about the natural world. And, notes the report, comparisons with other countries about knowledge and support for science "are not unambiguously reassuring."

Most of the available indicators have remained stable. That's both good and bad news. As the report concludes, "Stability may be a cause for concern to those who hope to see Americans become more knowledgeable or more supportive of science."

Kendrick Frazier is editor of the Skeptical Inquirer and a Fellow of the American Association for the Advancement of Science.

Study Explains Cognitive Illusion of ESP

Benjamin Radford

New research demonstrates that humans can subconsciously detect and assimilate changes in visual stimuli without knowing where that information came from or what exactly changed. The study suggests that this phenomenon of "knowing without knowing" can often be mistaken for psychic ability or supernatural intuition.

A team of researchers at the University of Melbourne led by Piers Howe presented test subjects with pairs of color photographs of the same person's face. In some cases the two photographs were identical; in others there were minor but significant differences (for example, in one photo the person might be wearing glasses or have a different hairstyle). Each photograph was seen for one-and-a-half seconds with a one-second break between the images. The subjects were then asked to determine whether or not a change had occurred—and if it had, to correctly identify the change from a list of possible options.

The researchers conclude, "In this study we have provided direct behavioural evidence that observers can regularly detect when a change has occurred without necessarily being able to identify what has changed.... We found that this ability to detect unidentified changes is not unique to images containing faces." Though the general phenomena (known as change blindness) has been known for decades, according to Howe this is the first scientific study to demonstrate that people can reliably sense changes that they cannot visually identify.

Howe noted that from the perspective of a person who "knows without knowing" (that is, knows something but doesn't know how or why she knows it),

> the experience was similar to that of a sixth sense, in that they could sense information that they believed that they could not see. We were able to show how this process worked and debunk the claim that this was due to a quasi-magical ability such as the sixth sense. The point is that people can sometimes get the strong impression that they can sense changes that they cannot see. What we showed was that while this sensing ability is indeed real, it has nothing to do with a sixth sense, and can be explained in terms of known visual processes.

The study, "Detecting Unidentified Changes," was published January 13, 2014, in the open-access online journal *PLOS-ONE*.

Benjamin Radford is deputy editor of the Skeptical Inquirer.

Americans Accused of Killing Daughter for Organs

Benjamin Radford

An Asian couple from Los Angeles with adopted African children went on trial in Qatar in November 2013, accused of starving their daughter Gloria to death in order to sell her organs. According to an article in *The New York Times*,

> Matthew and Grace Huang, an American couple with three adopted children from Africa, lived as a family in the affluent Persian Gulf kingdom of Qatar starting in July 2012. For most of the time since then, the parents have been imprisoned there, accused of starving their 8-year-old daughter to death with the intent of selling her organs.... The Qatar police investigators, in their report of Gloria's death, found the family's circumstances highly suspicious, and wrote that the girl had been emaciated. The defendants, they concluded in an investigation, "participated with others in child trafficking, most likely to either sell their organs or to conduct medical experiments on them."

Though this claim and situation is bizarre, it is not unheard of. I encountered similar rumors while investigating the kidney theft urban legends (see "Bitter Harvest: The Organ-Snatching Urban Legends," Skeptical Inquirer, May/June 1999). Folklorist Veronique Campion-Vincent, one of the world's top authorities on this type of story, notes in her book *Organ Theft Legends* that in some versions of this urban legend "the scenario is of pseudo-adoptions, in which children left poor countries only to die upon operating tables, not to be welcomed into loving families; it is commonly referred to as the Baby Parts Story, since organs taken from these children were allegedly used as 'spare parts' in transplants."

Matthew and Grace Huang and family.

Indeed, the prosecutor's accusations against the Huangs fit this narrative perfectly: a wealthy American couple adopted children from the poor West African country of Ghana only to kill one of them for her organs. Cultural misunderstandings may have played a role in the accusations; mixed-race families and adop-

Lucky Strike: Researchers Capture Ball Lightning

Sharon Hill

Ball lightning is a standard entry in collections of Fortean literature and anomalous natural phenomena. The origin of these glowing, hissing, sometimes explosive spheres remains mysterious. In some cases, the behavior is described as spookily intelligent or preternatural. Descriptions in size, color, duration, and motion vary. Initially supported solely by eyewitness accounts and without a mechanism for its formation, the reality of ball lightning has been controversial. Scientists have been thwarted in obtaining confirmation of this electrical manifestation due to its rarity and the dangerous weather conditions under which it appears.

A new paper published in the *Physical Review Letters* on January 17, 2014, provides evidence that ball lightning indeed does exist and supports a theory of how it is created and sustained. Three researchers, Jianyong Cen, Ping Yuan, and Simin Xue of Northwest Normal University, Lanzhou, China, observed the generation of ball lightning resulting from a cloud-to-ground lightning strike and reported on it in detail. The crew had set up spectrometers and high-speed video cameras to record conventional lightning during a thunderstorm in July 2012. To their surprise, one strike emitted the elusive glowing, floating "ball."

Their "lucky strike" hit pay dirt, so to speak, resulting in the first measurement of the emission spectrum of ball lightning, which showed atomic emission lines of silicon and other elements in the soil. This result suggests the elements—carbon, iron, calcium, and silicon—in the soil were vaporized where the bolt hit, forming a gas of energetic silicon atoms. These atoms then recombined with oxygen in the air, releasing heat and creating the glow of the "ball" for several seconds to a minute. This theory was one of an array of previously proposed ideas regarding ball lightning generation. The data from Cen et al. provide further support that this mechanism may be a way to create at least one type of ball lightning reported by witnesses. The size of the white to reddish glow they recorded was five meters across with the reactive glowing ball much smaller. Their observations note that the ball drifted horizontally for ten meters before dissipating upwards. The researchers plan to attempt to reproduce ball lightning in the laboratory.

Sharon Hill is editor of DoubtfulNews.com.

tions are virtually unknown in Qatar. One does not need to be a medical expert or a folklorist to see why at least some of the charges against the Huangs are absurd on their face. The couple may or may not be culpable for their daughter's starvation death (Gloria had been raised severely malnourished and treated for both intestinal parasites and an anorexia-like eating disorder), but the claim that she was murdered so that her parents could harvest and sell her organs is clearly groundless.

By starving their daughter to death they would be damaging the very organs they were supposedly trying to sell. Starvation can lead to failure of the kidneys, liver, lungs, heart, and other vital organs. If some evil person truly wanted to take little Gloria's organs, her death would have been quick and done under medical supervision so that the organs could be retrieved immediately. In the hours between the time the Huangs discovered their daughter in her room on January 15 and the time she later died at a hospital, most of her organs would have spoiled and become unusable.

One does not need to be a medical expert or a folklorist to see why at least some of the charges against the Huangs are absurd on their face.

Though organ sales do occur, there is no evidence of an organized black market in stolen organs. Historically, these organ theft accusations have often been leveled for political reasons. Investigator Todd Leventhal of the United States Information Agency (part of the State Department) noted in a 1988 report that during the Cold War the Russian intelligence agency KGB actively encouraged and circulated rumors about Americans abducting and killing children for their organs. As Campion-Vincent notes, "If any undeniable facts about organ thefts were established, they would become a major news item. They would be treated as such, making the front page of the daily papers and the lead item on the TV news." Still, two Americans are on trial based at least in part upon what is clearly a myth. The Huangs were released pending trial, but they are not allowed to leave the country. The case is ongoing.

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Ghost Hunters Burn Down Historic Mansion

Benjamin Radford

NOLA.com

A group of ghost hunters has been arrested for allegedly setting fire to a historic mansion in New Orleans, Louisiana. Perhaps inspired by the hit SyFy television series *Ghost Hunters* and its many imitators, a group of men climbed through a hole in a fence and broke into the LeBeau Plantation house near the Mississippi River on November 21, 2013. According to the St. Bernard Sheriff's Office, the men were looking for ghosts.

The mansion, built in the 1850s, had survived through many incarnations, including as a boarding house, a hotel, and even an illegal gambling house. Though the mansion had been shuttered in recent years, its owners—The Arlene and Joseph Meraux Charitable Foundation—had plans to renovate the building.

New Orleans has a rich history (happily promoted by its tourism board) of ghosts, voodoo, and mystery. LeBeau Plantation house is only one of dozens of gothic mansions and plantations rumored to be haunted. While some are more famous than others (the Myrtles Plantation, north of New Orleans in St. Francisville, is said to be one of America's most haunted homes and a prime destination for ghost hunters), it's hard to find a significant old plantation house in Louisiana that does *not* have at least one ghost story associated with it. Legends at LeBeau tell of a ghostly woman in a long white dress walking on the upstairs porch; other stories tell of spooky lights in the hallways or the voices of long-dead slaves.

While many ghost hunters engage in harmless (and fruitless) fun, as this case shows there can be a dark and dangerous side to ghost hunting.

The fire broke out at about 2 AM Friday, November 21, and the building was almost completely destroyed by the time firefighters arrived. The ghost hunters had been trying to provoke a reaction from the spirits they assumed resided there by doing what TV ghost hunters call "provocation," essentially making loud noises, yelling taunts at the ghosts, and banging on walls. Frustrated that their efforts failed to yield any spirits, the group decided to light a fire. Whether this was intended to smoke the spirits out or simply burn the place down, the mansion was reduced to just ashes and four brick chimneys before the fire department could respond.

While many ghost hunters engage in harmless (and fruitless) fun, as this case shows there can be a dark and dangerous side to ghost hunting. In the wake of popular ghost-hunting TV shows, police across the country have seen a surge in people being arrested, injured, and even killed while looking for ghosts. In 2006, a woman was critically wounded looking for ghosts in a private house near a cemetery; she and a friend were trespassing and the house owner mistook them for vandals and shot them. In 2010, a North Carolina man died while ghost hunting with a group of friends hoping to see the ghost of a train that crashed years earlier. The ghost train did not appear—but a real train came around a bend and killed the man, who couldn't get out of the way in time.

No one was hurt in the LeBeau blaze, which could have killed someone or spread to neighboring buildings. Seven men from Texas and Louisiana ranging in age from seventeen to thirty-one were arrested on charges including arson, simple burglary, trespass, and criminal damage worth more than $50,000.

Indonesian President Acknowledges Belief in Witchcraft

Benjamin Radford

Indonesia's President Susilo Bambang Yudhoyono looks at his wife Ani Yudhoyono as they wait for the arrival of Australia's Prime Minister Tony Abbott at the Presidential Palace in Jakarta in this September 30, 2013, file photograph. REUTERS/Beawiharta/Files (INDONESIA - Tags: POLITICS)

The president of Indonesia, Susilo Bambang Yudhoyono, stated in early 2014 what most Indonesians probably assumed: he believes in the existence of magic and witchcraft. According to a news story on ReligionNews.com, "In a recently published memoir, he describes a 'horror movie' style encounter with black magic at his residence: 'Suddenly, my wife screamed,' writes Yudhoyono in the 900-page book, *Selalu Ada Pilihan* ("There is Always a Choice"). 'There was this thick dark cloud hovering beneath the ceiling, trying to enter my bedroom. I then asked everybody to pray to seek Allah's help. I closed the door to my room but left others wide open. The revolving clouds eventually headed out of my house.'"

Indonesia is a largely Islamic country, and many Muslims—like many fundamentalist Christians—consider witchcraft an occult practice and therefore evil. A 2012 Pew Research poll found that "Among the Southeast Asian countries surveyed, Indonesian Muslims are the most convinced that witchcraft is real (69%)." Mysticism among world leaders is not unheard of. Nancy Reagan famously consulted an astrologer, who allegedly had some influence in the Reagan White House. But this revelation raises interesting issues.

India-BOOM

Like anyone else, the president of Indonesia has a right to his personal religious beliefs, but how might this affect how he rules the country? Yudhoyono's personal concerns over witchcraft are reflected in amendments his government made to the Indonesian Criminal Code last year, which included imprisonment of up to five years for using black magic to cause "someone's illness, death, mental or physical suffering." Yudhoyono also promoted a bill stating that "a person who declares himself to have magic powers may face a maximum of five years in prison or pay a maximum of Rp 300 million (US $30,969) in fines. The same applies to those who inform, encourage or offer such magic services to others."

Yudhoyono is not alone in his attempts to outlaw the use of magic in his country; in 2013 Mohammed Buqais, a government official in the Middle Eastern country of Bahrain, criticized his government for not doing more to educate its citizens—and particularly its young people—about the dangers of black magic and witchcraft. In an interview published by *The Gulf Daily News* Buqais stated, "I studied in school for twelve years and worked as a teacher for fifteen years, but never came across any subject that addresses sorcery or witchcraft. . . . This means the government is failing to raise awareness."

Mysticism among world leaders is not unheard of. Nancy Reagan famously consulted an astrologer.

Witchcraft has been blamed for many social and personal ills around the world, including countless homicides. In 1999, more than 200 suspected witches were killed in rural Indonesia, and hundreds more were taken into police custody to be protected from angry mobs. Whether the Indonesian president's affirmation of his belief in magic helps or hurts the situation remains to be seen.

Texas Couple Accused of Satanic Abuse Freed

Benjamin Radford

Among the last people caught up in the decades-old national hysteria over satanic ritual abuse were freed in November 2013 after spending over twenty years in prison. Fran and Dan Keller were sentenced to forty-eight years in prison after three children in their Austin, Texas, daycare claimed that they had been sexually abused by the couple and others in bizarre rituals beginning in 1991. Some children claimed, for example, that they were served Kool-Aid mixed with blood by figures in long white robes holding candles, were forced to participate in orgies with adults and other children, and were made to join in the butchering of babies and small animals.

No independent evidence was ever presented of the children's claims, many of which were logistically and physically impossible. Conspiracy theories were invoked to explain away the lack of hard evidence, suggesting that highly placed politicians and law enforcement officials were involved in a cover-up.

The Kellers' ordeal was only one of many high-profile cases in the 1980s and 1990s in which child abuse cases (often said to involve Satanism) rested on little more than claims of recovered memories. Children claimed to remember long-forgotten sexual abuse that never occurred, and innocent people were arrested and jailed. In one notorious case, Gerald Amirault, his mother Violet Amirault, and his sister Cheryl LaFave were accused of torturing children at the Fells Acres Day Care Center in Malden, Massachusetts. Several other notorious cases appeared across the country, including the Little Rascals and the McMartin Preschool trials. Children remembered being abused in a secret tunnel underneath a school, being taken to a church where strangers killed a rabbit and forced them to drink its blood, digging up dead bodies at a cemetery, and so on. Often there was little or no corroborating evidence to support the children's stories. For an excellent documentary about this subject, see *Capturing the Friedmans*.

Photo by Debbie Nathan

Fran and Dan Keller were freed in November 2013 after spending over twenty years in prison for accusations of Satantic child abuse.

The validity of repressed memories has since been thoroughly challenged by researchers such as CSI Fellow Elizabeth Loftus.

Fear and hysteria were whipped up by sensationalized stories on talk shows and in the news media, and books like the 1988 self-help best seller *The Courage to Heal* also promoted the idea of repressed memories. The authors (neither of whom has training in psychotherapy or science) erroneously told readers that they might have been sexually abused as children and simply repressed the memories. The validity of repressed memories has since been thoroughly challenged by researchers such as CSI Fellow Elizabeth Loftus. During the height of the satanic panic, the skeptical community was one of the most prominent voices calling for logic and reason to trump fear and hysteria. Though the panic of the 1980s and 1990s is over, other moral panics continue in America to this day, and skeptics must remain vigilant in reminding the public that accusations must be supported by evidence.

For a variety of reasons scientists are generally advised not to debate creationists, thus the certain trepidation when our colleague, the well-known television science educator and CSI Fellow Bill Nye, accepted an invitation for just such a debate about origins with creationist Ken Ham. The debate took place February 4, 2014, at the Creation Museum in Kentucky and was streamed live worldwide. Afterward the SKEPTICAL INQUIRER invited Bill Nye to give his own first-person view of this much-watched and much-discussed debate, the circumstances surrounding it, his preparations and strategy, and the reasons he decided to take part.

We also invited a vertebrate paleontologist and geochemist, Pennilyn Higgins, to provide her thoughts on the debate. Her short essay follows Nye's.

Bill Nye's Take on the Nye-Ham Debate

BILL NYE

This whole thing started when a crew from BigThink.com asked me about creationism. I was in New York to promote Internet-based science education. While on camera, I remarked that if you, as an adult, want to hold on to a completely unreasonable explanation of the Earth's natural history that is useless from a practical standpoint, that's your business. But we don't want our kids, our science students, to be indoctrinated into that weird worldview, because our kids are the scientists and engineers of the future. They need to be the innovators that drive the U.S. economy in the coming decades. These were offhand, albeit heartfelt, remarks, nominally off the topic I sat down to talk about. As of this writing, the excerpted video with my observations about creationism has logged over 6.3 million views.

Among the viewers apparently was one Ken Ham, who is the head of a congregation in Kentucky that holds doggedly to the idea that the world is somehow merely 6,000 years old. Furthermore, he has raised millions and millions of dollars for what he calls the "Creation Museum," a facility across the Ohio River from Cincinnati, Ohio, in Petersburg, Kentucky. He wrote to me and challenged me to a debate. For several months, I put the offer or proposal aside thinking the whole thing would blow over. After all, his challenge was based on a minute and a half of video that exists with little context. He was persistent. So, as the weeks went by and we corresponded, I acceded the challenge. More specifically, I was willing to come to his facility if the topic was: "Is creation a viable model of origins in the modern scientific era?" Note that this title does not include the word "evolution," nor does it connote or imply that we would discuss evolution specifically.

As you may know, once in a while I am invited to offer my thoughts on Fox News. And I love it—I love being in the studio right there with those reporters with the opportunity to look them in the eyes (or lens). As you may infer, I'm not much for their style, and I usually disagree with just about everything a Fox commentator has to say, but I relish the confrontation. I had that same feeling about Ken Ham's building. I wanted to be in the belly of the beast. I drove by there when I was on other business in Cincinnati a few years ago. The building was closed, but driving around the grounds I saw numerous depictions of ancient dinosaurs. One infamous sculpture featured humans of apparent European descent astride a triceratops-style ancient animal adorned with Christmas lights. I wanted to see the inside someday.

I do about a dozen college appearances every year. It's a privilege that I enjoy immensely. At first, I figured this appearance and this encounter would get about the same amount of notice as

a nice college gig. There'd be a buzz on Twitter and Facebook, but the world would go on spinning without much notice on the outside. Not here: the creationists promoted it like crazy, and soon it seemed like everyone I met was talking about it.

I slowly realized that this was a high-pressure situation. Many of you, by that I mean many of my skeptic and humanist colleagues, expressed deep concern and anger that I would be so foolish as to accept a debate with a creationist, as this would promote him and them more than it would promote me and us. As I often say and sincerely believe, "You may be right." But, I held strongly to the view that it was an opportunity to expose the well-intending Ken Ham and the support he receives from his followers as being bad for Kentucky, bad for science education, bad for the U.S., and thereby bad for humankind—I do not feel I'm exaggerating when I express it this strongly.

I believe I am generally not the stereotypical male who refuses to ask for directions. I feel locals usually know the way best. By analogy, to find my way through this debate (which was quickly becoming a big damn deal), I consulted the world's foremost authorities on arguing or debating with creationists. I flew to Oakland, California, and consulted with the famed, venerable, and formidable Genie Scott, along with Josh Roseneau, and the staff at the National Center for Science Education (NCSE). They schooled me on what to do in great detail. Later that week, I managed to arrange a lunch with Don Prothero and Michael Shermer, two hardcore skeptics. Don even debated the notorious Duane Gish back in the 1980s. All of these people were wonderfully helpful. They were very patient with me and helped me figure out what to say and, especially, what not to say. They said to prefer the word "explanation" to the word "theory," for example. I just can't thank them enough.

With that said, and everyone profusely thanked, I was going to be on my own in this thing, and I had to make my arguments come from my heart (a metaphor for my point of view—from my brain).

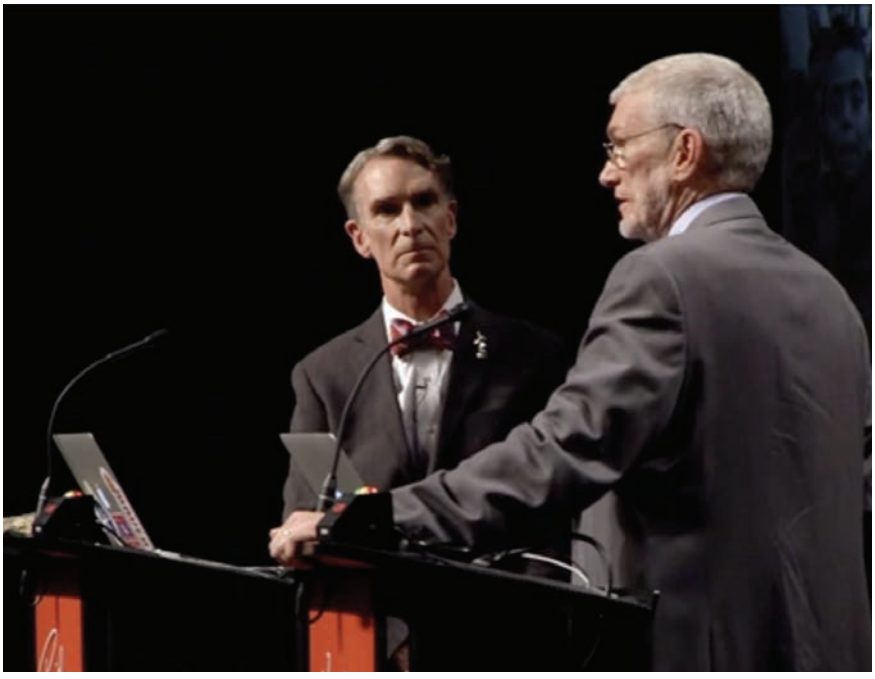
I am by no means an expert on most of this. Unlike my beloved uncle, I am not a geologist. Unlike my academic colleague and acquaintance Richard Dawkins, I am not an evolutionary biologist. Unlike my old professor Carl Sagan or my fellow Planetary Society Board member and dear friend Neil deGrasse Tyson, I am not an expert on astrophysics. I am, however, a science educator. In this situation, our skeptical arguments are not the stuff of PhDs. It's elementary science and common sense. That's what I planned to rely on. That's what gave me confidence.

In this situation, our skeptical arguments are not the stuff of PhDs. It's elementary science and common sense. That's what I planned to rely on. That's what gave me confidence.

With my experience as a science educator, I like to divide elementary science into three categories: life science (biology), physical science (physics and chemistry), and planetary science (geology and astronomy). And so with the remarkable help of the NCSE and skeptics, I chose arguments from each of these three disciplines.

On the slides in my "decks," as they're called, I do not use many words. My colleagues sent me dozens of PowerPoint slides for my use. Thank you of course, but my goodness you all, when I watch many of your presentations, it's like reading a page of book projected on a wall. How can someone in the audience focus on what you're saying, when there's a blizzard of words in front of her or him?

Those of you familiar with creationism and its followers are familiar with the remarkable Duane Gish (no longer living—at least as far as we know). His debating technique came to be known as the "Gish Gallop." He was infamous for jumping from one topic to another, introducing one spurious or specious fact or line of reasoning after another. A scientist debating Gish often got bogged down in details and, by all accounts, came across looking like the loser.



It quickly occurred to me that I could do the same thing. If you make the time to watch the debate (let's say for free at http://billnye.com—wink, wink), I hope you'll pick up on this idea. I did my best to slam Ken Ham with a great many scientific and common sense arguments. I believed he wouldn't have the time or the focus to address many of them.

The night before the debate, I spoke at Murray State University in Murray, Kentucky. The students there were keenly aware of the next evening's debate. I had a long car drive from one side of the commonwealth to the other. I could not help but notice the layers and layers of beautiful limestone everywhere along the road. We pulled over at a cut where some blasting took place for the road's right-of-way, and I walked through a few centimeters of snow. I easily picked up three nice specimens of rock revealing several fossilized small shelly ancient sea creatures. I held one up during my opening remarks. There's an irony that the Creation Museum literally sits atop overwhelming evidence of the true age of our planet.

I've got to mention another thing to you all. To a man and woman, all of my advisors, NCSE staff and skeptics alike, strongly felt that the desirable position in a situation like this is to go first. This, many of you believe, puts the onus on the other guy or gal to refute your points. I just don't see it that way. This may be from experience in television, or it may be my misguided overconfidence; I wanted to go second in the confrontation.

To you go-firsters I say: "You may be right." I mean you may be right, if this were a debate in an academic session, where there are thoughtful judges from the history department or tort instructors from the law school, who have the ability to determine who said what better than who to whom, per se, et cetera. But this debate was a television show. And my audience was on the worldwide web not in the auditorium. If I get the chance, I go second. I just don't see it any other way. Whatever Ken Ham talked about, I pretty much planned to talk about what I wanted to talk about.

My agents and publicist induced Tom Foreman from CNN to moderate the event. Mr. Foreman was the ideal man for the job. He's a thoughtful journalist with a great deal of experience in handling human conflict as he seeks the facts in a story. However, having a respected international journalist sitting on stage with us upped the ante. There would be even more focus and more scrutiny from an even bigger audience. As they say in the theater, if you stop being nervous, stop going out on stage. The key is to take that nervousness or anxiety and convert it to excitement. By the time the debate was ready to start, I sensed that Mr. Ham was nervous, while I was excited.

I felt joy as I talked about the best theory we have to explain why meta-life forms like dandelions, velociraptors, humans, and minnows have and had sex. Yes, I said, "Sex—sex, sex, sex" to the auditorium audience.

Tom Foreman, by long debate tradition, tossed a coin backstage. Ken Ham won the toss, and probably taking advice from his people, who were thinking a lot like my people, chose to go first. I was delighted.

From long experience behind unfamiliar lecterns in strange venues, I can tell you: something always goes wrong and you've got to roll with it. As I stepped up to my lectern, stage-right of Ken Ham, I realized that I had loaded a previous revision, an unintended version, of my first set of five slides for our first five minutes of presentation. I'll let you, the viewer, determine which one I intended to leave out. Phew. . . .

If you take the time to watch, Mr. Ham repeatedly mentioned or droned on about the less-than-a-handful of scientists who subscribe to the weird idea that the Earth is crazy (or crazily) young. When my turn came, I talked about geology and the Grand Canyon. Creationists from the United States, or in Australian-born Ham's case, *in* the United States, just can't get enough of the Grand Canyon. I pointed out that not a single fossil form had tried to swim from one rock layer to another during his purported worldwide flood, only 4,000 years ago. Were we to find such a fossil, it would utterly change geology and our scientific worldview. I did a bit of engineering, pointing out that no wooden boat has ever been built as big as Ham's imagined ark. In fact, the big ones that were built were smaller and generally twisted apart—and sank (for this I used a chart from Ham's website). I made it personal where possible. The Nyes are an old New England family, many of whom sailed wooden ships. I also spoke of decades in the Pacific Northwest, where I observed the enormous boulders washed westward by ancient collapsing ice dams in what is now Montana.

In keeping with the idea of getting the audience to like me, I spent my first minute and a half on a joke about bow ties. I'm not sure how many of my academic colleagues would have made that choice, but I stand by it.

I pointed out that evolution is a successful theory, because it enables us to make predictions. I showed a map, a fossil, and an artist's rendering of Tiktaalik, the extinct but quite real lizard-fish. And, I felt joy as I talked about the best theory we have to explain why meta-life forms like dandelions, velociraptors, humans, and minnows have and had sex. Yes, I said, "Sex—sex, sex, sex" to the auditorium audience. Many

seemed to have their heads tossed back the way our heads move when we encounter an oncoming two-by-four.

I've met several people who loved (or very much enjoyed) my reference to kangaroos. Thanks to Genie and her colleagues for that: If kangaroos got off the ark in Mesopotamia, why aren't there kangaroos in Laos? (Again, I used a map from Ham's very website.) Then, from geology: If I find ice that has evidence of 680,000 layers of summer-winter cycles, how could the Earth be any younger? Thanks to Don for that. How can there be 9,500-year-old trees if the Earth is only 6,000 years old? And so on.

Something else I'd like to point out: From the beginning, I told Genie et al., that at some level, this thing has to be fun. Otherwise, it's hard to be passionate and have the audience like you. Put another way, what is it that you or each of us loved about your favorite teacher or professor? I believe it's his or her passion. It was Mr. Lang, my teacher who loved physics, who got me excited about airplanes, mechanisms, and electronics. To that end, I included a bit from astronomy. I talked about the big bang and why we, in the rest of the world, believe in it and are filled with joy by it. I figured that Mr. Ham would be at best apologetic, and at worst, just plain bewildered by it. I leave any conclusion about his reaction up to you.

Perhaps there was no winner, as this was not a scored debate. Nevertheless by all, or a strong majority of, accounts, I bested him. The fundamental idea that I hope all of us embrace is, simply put, performance counts as much or more than the specifics of the arguments in a situation like this. I admit that, for me at least, it took tremendous concentration. I was and am respectful of Ken Ham's passion. At a cognitive level, he believes what he says. He really means it, when he says that he has "a book" that supersedes everything you and I and his parishioners can observe everywhere in nature around us. I respected that commitment; I used it to drive, what actors call, my "inner monologue." I did not choose, as I was advised, to attack, attack, attack. My actor's preparation helped me keep things civil and be respectful of Mr. Ham despite what struck me as his thoughtless point of view. I'm sure it influenced the countless people who've written to me and come up to me in public to express their strong and often enthusiastic support. Thank you all.

After the debate, my agent and I were driven back to our hotel. We were, by agreement, accompanied by two of Ham's security people. They were absolutely grim. I admit it made me feel good. They had the countenance of a team that had been beaten—beaten badly in their own stadium. Incidentally, if the situation were reversed, I am pretty sure they are trained to feel bad about feeling good. They would manage to feel bad either way, which is consistent with Mr. Ham's insistence on The Fall, when humankind took its first turn for the worse. And by his reckoning, we've been plummeting ever since.

In an interview after the debate, Piers Morgan of CNN asked Mr. Ham about climate change. Ham denied denying it, but I reminded the audience that he did deny climate change in at least one interview. It's somehow connected, because it points to Ken Ham and his followers' ability to exclude themselves from responsibility and from nature. It is weird and, for me, troubling.

A few weeks after the debate, Answers in Genesis held an online event in which they announced that they have or had raised the funds for their amazing "Ark Encounter" theme park, or "Ark Park." I posted a tweet on the Twitter social media site, "Here's hoping voters & journalists wonder: where did all those $ millions come so quickly? After a deadline?" Soon after that, Mark Looy of AIG sent an email to my office assuring me that the bonds had already been secured, before Feb. 4, i.e. before the debate—and before the unrated bonds' deadline. I could not help but notice that Ken Ham made no mention of this during our encounter, i.e., during the debate itself. I also could not help but notice that his colleagues suggested that the debate helped close certain aspects of their Ark Park deal, later during their online event—at which not a single journalist, or anyone else for that matter, was present. These are details, but it does make me wonder, who donates those millions? I wonder if one project is leveraged against the other. I'll leave it to the Kentucky journalism community to seek answers in this funding genesis.

I very much hope this whole business galvanizes the people in the Commonwealth of Kentucky and in neighboring states to take the time to think critically about creationism and to vote to remove it from science classrooms and texts. I frankly hope that in the coming few years not a single student in Kentucky is indoctrinated by the Answers in Genesis facilities and staff.

No matter where this leads, thanks to all of you, who've helped me over the years and in recent weeks to think critically and speak clearly about science and reason. It's in the national interest to enlighten young people. The longest journey starts with but a single step. In this debate, we've already traveled a long way, but with projects like the Ark Park still in play, there is quite a journey yet ahead. If we keep making our arguments clear, and continue to vote and fight the political fights, together we can change the world. ■

Copyright Bill Nye

Bill Nye (The Science Guy) is chief executive officer of The Planetary Society. He learned his love of astronomy from Carl Sagan while earning a mechanical engineering degree at Cornell University. He was the writer, producer, and on-air talent for the Emmy Award-winning *Bill Nye the Science Guy* TV series from 1992–1998. More recently his program *100 Greatest Discoveries* aired on the Science Channel. He is a Committee for Skeptical Inquiry fellow and was the keynote speaker at the recent Center for Inquiry/CSI/CSH Summit Conference in Tacoma, Washington.

Was Special Creation De-Nye'd?

PENNILYN HIGGINS

So this happened.

Bill Nye (the Science Guy) and Ken Ham (president and cofounder of Answers in Genesis) had a debate pitting the modern theory of evolution against Biblical Creation.

I didn't watch the debate when it happened. I tried to ignore it. I knew that if I watched it, I'd be yelling at the television in frustration over hearing the same old tired arguments again.

In the days following the debate, I was asked repeatedly if I'd seen the debate, and what I thought. I had no answer, of course. I hadn't watched it.

I read articles about who won and who didn't and why. Some felt that the debate hurt science. Others thought the debate was pointless. Some shouted that the exposure brought by having Bill Nye present science's side would bring in an audience not usually reached. Others argued that the whole thing gave undeserved credibility to non-scientific ideas like young-Earth creationism.

I realized that I actually needed to see the debate. The answer to the question at hand matters a great deal to me. I'm a geologist and paleontologist. Proof of a 6,000-year-old Earth would negate the very foundation upon which I work.

I wanted to know what type of creationism Ham would present. I wanted to witness a debate on this topic where both sides were represented by charismatic people. (Let's be honest, scientists aren't often all that charming.) I wanted to know if Ham would bring some new argument to the table that I'd never heard, if he was going to stick to the word of the Bible, or attempt to apply scientific methods to support his claims. If Ham did try to use science to support his hypothesis that the Earth is only 6,000 years old, I wanted to see what he did and how Nye responded.

I was equally curious to know if I really would yell at the TV, or if I would be silenced by unexpectedly compelling arguments.

So I watched it.

I suppose that's where Ken Ham and I would agree: The scientific method fails at supporting his hypothesis of Creation. What we disagree upon is the implication of the fact that science can't support Creation.

The defined topic of debate was "Is Creation a viable model of origins in today's modern scientific era?" This is a little different from asking, "Which is true, Creation or Evolution?" which is, I suspect, what a lot of people thought the debate was going to be about. Ken Ham took the position of, "Of course Creation is supported by science," outlining what he thought were predictions made by the Bible and borne out in the modern world. Bill Nye's stance was that Creation was in no way a viable scientific hypothesis because its conclusions directly contradict modern scientific understanding.

I have given a lot of thought to the question of whether or not science could support creationism. My conclusion is that the hypothesis of special creation happening about 6,000 years ago cannot be supported by science. It cannot be tested using the scientific method.

And I suppose that's where Ken Ham and I would agree: The scientific method fails at supporting his hypothesis of Creation. What we disagree upon is the implication of the fact that science can't support Creation. I conclude that special creation, as described in the Bible, is not the best explanation for the origin of the diversity of life (including humans) on this planet. Ham concludes that Creation did happen, and that science, specifically what he calls historical science, just doesn't work.

That's Ham's fundamental argument throughout. He argues that observational science—that is, experiments and tests run in modern times that can be actually watched—is a valid way of answering questions. Historical science—any inferences we might make about the past—in Ham's

view can't be done. We weren't there to see these events. How can we know what happened?

Essentially, what he's saying is that all interpretations I make as a paleontologist and geoscientist are just guesses on my part because I wasn't there to see it, and we can't know that things weren't working differently then.

Nye argues back (and I agree) that there is no distinction between "observational" science and "historical" science. In either case, we develop hypotheses, make predictions based on those hypotheses, then look to see if our predictions are borne out. We assume that natural laws haven't changed since the origin of the universe, and certainly not since the origin of the Earth.

Ham claims that he agrees that natural laws haven't changed in the last 6,000 years, but in the next breath he tells us that since we can't observe something happening in the past, we can't assume that things worked the same in the remote past as they do today. For example, we know that layers of ice in the Antarctic ice cap are annual features, and with cores we can count hundreds of thousands of layers, negating the concept of a 6,000-year-old Earth. Ham would say that things were different early on, so counting ice layers is not a good measure of years. But if natural laws haven't changed, then counting ice layers is a perfectly valid way to estimate time.

This is the part where I started yelling.

These are, alas, the same arguments I've heard before, rehashed by a charismatic man. Ham was picking and choosing ideas from intelligent design and from creation science to support his notions, but when really pinned down, his response was usually, "I have this book. It has the answers." Even when he was specifically asked what evidence *besides* the word of the Bible supports the hypothesis of creationism, his answer was the same: the Bible was all the proof he needed. He went so far as to admit nothing would change his mind.

It was disappointing.

One good thing that came from the debate, however, was that Ham provided a functional definition of "kind," as in "each animal after its own kind." On Noah's ark were two members of each kind, male and female, which after the flood went on to populate the Earth and diversify into the numerous species we see today. The dog kind and the horse kind and so on. So the horse kind evolved rapidly in the 4,000 years since the flood resulting in zebras, donkeys, and thoroughbreds. This type of evolution, called microevolution, is fine to creationists, because no new kinds are created.

Ham was picking and choosing ideas from intelligent design and from creation science to support his notions, but when really pinned down, his response was usually, "I have this book. It has the answers."

For years I've been frustrated that there's been no proper or useful definition of "kind." Ham was nice enough to provide a definition, saying that a kind, in the Biblical sense, is at about the level of family in the Linnaean taxonomic hierarchy. Thus, the family Equidae, which includes zebras, donkeys, and thoroughbreds, represents the horse "kind." The family Canidae, which includes foxes, wolves, and the domestic dog, represents the dog "kind."

This seems great, but in practice doesn't work very well. All levels within Linnaean taxonomy are arbitrary, except for species. They are convenient constructs for us to discuss organisms but don't necessarily have any basis in actual evolutionary relationships. This is why all scientists studying evolution use cladistic analysis to determine relationships. While the family level might seem sensible when looking at mammals, it doesn't work out the same for birds or insects or reptiles.

I could go on, but I won't. I have my own research that I want to work on. Exciting stuff. Clues to possible futures by looking at events that happened millions of years ago.

We have a wealth of evidence supporting an ancient Earth. This evidence is tested and supported using the scientific method, which works when looking at the past as well as when conducting experiments in modern times. There's no reason to think the laws of nature have changed in the last 6,000 years, or in the last four billion years.

The breadth of information that Nye covered during this debate reminds me of the amazing insight that science provides for us in order to better understand our world—not just the age of the Earth but everything—all of which is made available to us by application of the scientific method. What Ham has is a book offering an explanation for the origin of the diversity of life on Earth that made good sense back when it was written, before we knew a hundredth of what we know now. He loves that book. What it says makes him feel good. But it's not science, and cannot be supported by science. ■

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[INVESTIGATIVE FILES JOE NICKELL

Joe Nickell, PhD, is CSI's senior research fellow. A former stage magician and private detective, he has—since 1969—investigated numerous cases of alleged ghosts, poltergeists, and demons from a scientific perspective.

The '200 Demons' House: A Skeptical Demonologist's Report

Sparking an international media frenzy, a house in Gary, Indiana, was—according to two unnamed "clairvoyants"—besieged by over 200 demons. Of three "possessed" children, the daughter "levitated"; one son, who talked with an invisible boy, growled and spoke in a deep voice; and his older brother walked backward up a hospital exam-room wall! Investigating Gary police confessed themselves baffled. A captain's personal car seemed to have become possessed when its driver's seat began to move inexplicably to and fro.

After the family moved out, the subsequent renter found herself besieged by curiosity seekers after the events were publicized and sought relief. At one point she called police to complain of reporters and photographers who were on her property. The mother of the "possessed" children also was not talking—except to a national TV show with which she reportedly had an exclusivity agreement. Various agencies and individuals were noncommittal as well, citing issues of medical confidentiality and privacy. Nevertheless, CSI dispatched me to investigate the case. As I would discover, the devil was in the details.

Figure 1. At the Gary, Indiana, "200 demons" house, the later resident talked with Joe Nickell (out of view at right). Photo by Steve Duerr.

Demon House?

The alleged demon house is a nondescript rental cottage with enclosed porch at 3860 Carolina Street in Gary, the onetime "murder capital of the U.S."

Although not reported publicly until January 28, 2014 (Kwiatkowski 2014a), the strange events began soon after Latoya Ammons moved into the house with her three children (then seven, nine, and twelve, respectively) and her mother, Rosa Campbell, in November 2011. Campbell recalled a profusion of flies that swarmed their porch in December; that motif recalls the Amityville horror house of the mid-1970s—a case that proved to be a hoax (Nickell 2012, 293).

Soon came noises that Ammons interpreted as footsteps on the basement stairs and the creaking of the basement door—consistent with the sounds old houses commonly make with changes in temperature (Nickell 2012, 111–112). In one incident, her mother reportedly awoke to see a "shadowy figure" and "leaped out of bed" to find "large, wet bootprints" (Kwiatkowski 2014a). However, the earlier report of a priest seeking permission to conduct an exorcism (Maginot 2012) stated that it was the *next morning* that "they saw on the wooden floor of their living room what looked like muddy footprints like from a boot." Campbell probably had a common "waking dream," which occurs between being fully awake and asleep (Nickell 2012, 353–354). As to foot-

marks that might have been made at any time, one does not need to invoke the supernatural to explain them.

Significantly, there were never any reported haunting or demonic activities in the house other than during the Ammons family's tenure. The landlord, Charles Reed (2014), insists there had never been any such problems before they took up residence. While to the Department of Child Services (DCS) Ammons blamed her children's irregular school attendance on the demons—saying "the spirits would make them sick, or they would be up all night without sleep"—in fact the family had a "previous DCS history regarding educational neglect" (Washington 2012). Records show the agency made that finding in 2009 (Kwiatkowski 2014a).

As well, as Charles Reed (2014) noted, there were no alleged demonic activities during the tenure of the subsequent renter. The only thing that was scaring the new tenant was local curiosity, notably that Gary police officers were frequently driving by the house, and Reed phoned the department to ask them to stop. Reed, who has thirty-three years' experience as a landlord, told *The Indianapolis Star*: "I thought I heard it all. This was a new one to me. My belief system has a hard time jumping over that bridge." I called to ask if anything had occurred since to change his view, and spoke with his wife Nancy Reed (2014). Although she stated that they were making no further comments about the case and had obtained an attorney, she did answer my question: She said her husband's skepticism remained unchanged.

Although Mrs. Reed told me that the current tenant did not want to be disturbed—and that was obvious, given that woman's having called police to report bothersome reporters and photographers—nevertheless I was on assignment for CSI and determined to take my best shot. Arriving at the residence (with Steve Duerr of CFI–Indiana, who took the photo in Figure 1), I saw the woman resident in the doorway and a male companion putting something in a car parked in front. I bailed out of Steve's car and approached. I began by identifying myself and apologizing for the interruption. Although she continued her position of making no comments, she was not unpleasant to me and we actually spoke for ten to fifteen minutes.

When I said offhandedly that she no doubt knew of the alleged incidents better than I, she quickly replied, "Not really," explaining that she had not followed the case and only wanted to live in peace. The gentleman interjected, pointedly calling the reputed demonic events there "hocus-pocus"—adding, "or whatever." He informed me they were moving out. The house had been purchased—for $35,000—by Zak Bagans, the executive producer and host of the Travel Channel show *Ghost Adventures* (Kwiatkowski 2014b).

Countless historical examples show that such disturbances typically center around a child or children and involve mischief a child could cause and, indeed, many times was actually *caught* causing. I call this activity the *poltergeist-faking syndrome*.

Poltergeists?

Soon after the Ammonses had moved into the house on Carolina Street, the ghostly goings-on transformed into a full-blown case of poltergeist activity—after the German word for "noisy spirit." The oldest son told a child psychologist that "doors would slam and stuff started moving around." The youngest son, according to Ammons "was once thrown from the bathroom when no one was even near him" (Kurp 2014). A religious statue was broken (Maginot 2012). Ms. Ammons told DCS that if the children were not asleep by eleven in the evening, "the spirits would come out and keep them up all night throwing things, moving things in the home," and so on (Washington 2012).

Countless historical examples show that such disturbances typically center around a child or children and involve mischief a child could cause and, indeed, many times was actually *caught* causing. I call this activity the *poltergeist-faking syndrome* (Nickell 2012, 325–331). Motivation varies: In one newly tenanted home mysterious fires resulted when a boy missed his former playmates; a schoolhouse outbreak was inspired by the gullibility of their teacher and townsfolk; and other "poltergeist" antics were produced by an eleven-year-old girl looking for attention. All such motives could apply to the Ammons children.

First, the children's move to a new neighborhood might have caused difficulty. Lacking new playmates, they may have begun to irritate each other, resulting in Ammons reporting to their physician "that the children fight one another and are abusive to one another and then they pass out" (Washington 2012). (In other words, they act out their anger but pretend not to be responsible.)

Second, the mother's response to the occurrences encourages their misbehavior. Consider the DCS report giving information from a knowledgeable confidential informant—apparently a medical professional—who complained to the department. He is referred to as "RS" (for Report Source, cited in Washington 2012):

> RS states [one of the boys] reported there are ghosts in the home, thousands of them and he can see them. . . . [T]hey don't talk to him but after the mother tells [him] that he can tell the medical professionals the truth he later says yes. . . . RS states they believe the children are performing for the mother and that she's encouraging the behavior.

Mother Sets the Stage

Latoya Ammons is a religious believer who has a high superstition quotient. She believes in invisible entities and consults "clairvoyants," one of whom told her "the house was infested by demons." She insisted to *Inside Edition*, "I know that for a fact" (Ammons 2014). At the suggestion of one of two clairvoyants who claimed the house was "filled with more than 200 demons," a frightened Ammons created an altar in the basement where the terrifying events were believed to have begun. It consisted of a statue of the Holy Family—Mary, Joseph, and Jesus—and a white candle and incense burner (Maginot 2012). The Gary police observed "multiple religious shrines" and "bibles throughout the home" (Washington 2012).

She told medical personnel that her home had "various demons and evil spirits due to someone dying in the home," and that she had "taken the children to various temples and churches to remove the demons." One psychologist said of Ammons that she did not appear to be "experiencing symptoms of psychosis," but another wondered "whether her religiosity may be masking underlying delusional ideations or perceptual disturbances" (qtd. in Kwiatkowski 2014a).

Several professionals concluded that the children were acting deceptively and in accordance with their mother's beliefs. For example, a psychologist who evaluated the youngest son reported that he tended to "act possessed" whenever he was challenged or redirected, or when he was asked questions that he did not wish to answer. She went on to observe that the boy seemed both coherent and logical—except when he was talking about demons. Then, his stories became "bizarre, fragmented and illogical," she said, adding that the stories changed every time he related them (Wright 2012).

The psychologist determined that the boy did not have an actual psychotic disorder, concluding, "This appears to be an unfortunate and sad case of a child who has been induced into a delusional system perpetuated by his mother and potentially reinforced," she said, by other relatives (Wright 2012).

Latoya Ammons is a religious believer who has a high superstition quotient. She believes in invisible entities and consults "clairvoyants," one of whom told her "the house was infested by demons."

As a consequence of their evaluations, the DCS removed the children from Ammons. The agency stated that she needed to employ "alternate forms of discipline not directly related to religion and demon possession" (DCS Case Plan 2012). Ammons was permitted supervised visitation and, after about six months, the children were returned to her in November 2012. Meanwhile—outrageously—no fewer than four exorcisms were performed on her by a priest named Michael L. Maginot, one with his bishop's official permission—though not on the children who were allegedly possessed! Ammons now says her children left their demons behind, but she credits God, not psychologists or the DCS, with resolving the family's problems (Kwiatkowski 2014b).

Demonic Phenomena

It remains to discuss the phenomena that so astonished other superstitions folk involved in the case—including the priest, his bishop, and one Captain Charles Austin of the Gary police. Like Ammons, Austin has a high superstition quotient. Already an admitted believer in the supernatural, including ghosts, he became a believer in demons after visiting the house on Carolina Street (Kwiatkowski 2014a). It didn't take much: He and other officers naïvely played ghost hunters. They used cameras and Austin's iPhone to snap pictures in which they could see—in mottled shadows and cloudy white forms (such as can be caused by a rebounding flash)—shapes that resembled faces and figures. These are called *simulacra*, the result of one's ability to perceive images in random patterns (Nickell 2012, 64–65).

One such exterior photo, showing what looks vaguely like a blurry image of a person standing in a porch window, might have been a simulacrum, or a reflection of someone on the sidewalk, or a fake photo, as from a cell phone's hoax app (Flynn 2014). Although *The Indianapolis Star* captioned it "Photo by Hammond Police," it was not. The Hammond Police Chief assured me it was not an official police photo, that agency having had no involvement in the case, never mind what may have been produced unofficially by an individual (Miller 2014). At present, the photo is too questionable to be admissible as evidence.

Again influenced by television ghost shows, the officers used a tape recorder to supposedly record spirit sounds—or rather a sound, perceived as the word *hey* (Kwiatkowski 2014a). Such electronic voice phenomena (EVPs, as they are called in the parlance of ghost hunting) are typically verbal simulacra—that is, syllable-like effects perceived in the randomness of static and background noise (Nickell 2012, 146, 273). In this instance it appears to have been an *inadvertent* aspiration (it is not

the word *hey*) made by a person close to the microphone at the time (Flynn 2014). Ghost hunting involving such equipment is a pseudoscientific pursuit and a fool's errand. As to Captain Austin's self-moving car seat, his mechanic found that his driver's seat motor was simply broken (Kwiatkowski 2014a).

Turning to the phenomena attributed to the children, these were obviously produced by the children themselves. Anyone who has seen any of the countless TV shows and movies that have proliferated since the 1973 horror movie *The Exorcist* would know how to manipulate his or her eyes, growl, speak in a deep voice, feign a trance, scream and thrash, or otherwise simulate being "possessed." When the youngest Ammons boy was "lifted and thrown into the wall with nobody touching him" (Washington 2012), it is apparent he simply launched himself.

Similarly, when his sister "reported being thrown across the room and grabbed by dark shadows" (Washington 2012), she was no doubt self-propelled—if, given the word "reported," the event happened at all. Much has been said about her having been "levitated" above a bed (Kwiatkowski 2014a)—part of the stock effects of alleged demon possession as shown in numerous movies. However, no levitation has ever been documented by science. The girl's mother has given different versions of the feat, but when she mentioned the incident on *Inside Edition* (Ammons 2014), she did not use the word *levitation*. Rather, she stated that as she watched, "It [a demon] attacked [her daughter] and it raised her up off the bed, snatched her off the bed"—describing a quick action, not a prolonged floating. I take it that, as with the other incidents, the twelve-year-old simply propelled herself upward, no doubt taking advantage of the springiness of the mattress. (If she arched her body, supported at head and feet, she might have appeared to float briefly.)

The most significant claim involved the oldest son and described him—as sources endlessly repeated—"walking backward up a wall" in front of witnesses including a DCS case manager and a nurse. The incident happened at Lakewood Methodist Hospital, where I talked with a public relations official (Morrison 2014) but was not allowed to speak to the nurse; I also met the case manager Valerie Washington (2012), but her superiors also did not permit her to speak about the matter to me. Nevertheless, I can say that there was more to the incident than people learned from some sources—such as the *New York Daily News* (Golgowski 2014), which had the mother claiming demons caused her son "to walk on a hospital ceiling."

The accounts tend to imply that gravity was overcome, proving a supernatural occurrence. In fact, while the boy put first one foot, then the other, onto the wall of a small hospital exam room, his grandmother, Rosa Campbell, was holding his hand (Washington 2012) or both of his hands (Ammons 2014). Thus the laws of physics were not contravened. The boy was obviously supported, braced by the rigid arms of Campbell who no doubt instinctively steadied him and helped him maintain his balance as he progressed, perhaps to the ceiling, "and he never let go. He flipped over and landed on his feet in front of the grandmother and sat down in the chair. A few minutes later he looked up as if he was back to himself" (Washington 2012). In short, this was a stunt of an agile boy, not in the least proof of the supernatural.

The priest (Maginot 2012) reported flickering lights, appearing oil, and a litany of other incidents, including some that he was only told about. For instance, a bottle "levitated" and wobbled before being thrown into Latoya Ammons's bedroom, a common "poltergeist" act) where it broke a lamp. (Too bad the object was not dusted for fingerprints. I suspect Ammons misperceived, first seeing the bottle in mid-flight traveling approximately toward her—conditions like those that sometimes cause airplanes to be reported as "hovering" UFOs [Hendry 1979, 37–38]). Ammons took the family to her brother's, "but the entity seemed to follow them there"—a fact that should surprise no one. Maginot's report (2012) is rife with the logical fallacy called arguing from ignorance ('we don't know what caused this, so it must have been demons').

Continuing Saga

It was not enough that the Rev. Michael Maginot helped foster ignorance and superstition in the case, at the expense of science and reason, but he seemed happy to become a star—presumably with his bishop's blessing (if that is the right word). Maginot contracted with Zak Bagans of *Ghost Adventures* to produce a documentary on the case. He also signed a contract with Evergreen Media Holdings—whose chairman, Tony DeRosa-Grund, produced the horror movie *The Conjuring* (previously exposed in SI as nonsense [Nickell 2014]). Worldwide, that movie grossed $318 million. Apparently with a straight face, Maginot told a reporter the reason he signed with Evergreen was that he felt DeRosa-Grund *would not sensationalize the case* (Kwiatkowski 2014c)!

Another hopeful is Captain Charles Austin, whom I twice tried to reach on visits to the Gary police station. According to the *Indianapolis Star*, he "said he expected notoriety and figured a movie would come of this" (Kwiatkowski 2014b). He is right so far, but if he is not careful, his legacy may be that of one more person lampooned for being on a fool's errand.

As to Ammons, she was apparently so eager to tell her story to *The Indianapolis Star* that she signed releases giving access to her family's medical, psychological, and social records in otherwise restricted files. Stated the reporter (who made them available to researchers: see Kwiatkowski 2014a for urls), they were "not always flattering."

In summary, no demons possessed anyone in this case, except in the figura-

tive sense. What were really unleashed were the dark aspects of superstition, ancient dogma, lust for notoriety, the greed of cynical hucksters, and the stubborn unwillingness of some to be reasoned with. ■

Acknowledgments

Barry Karr, CSI executive director, arranged for me to go to Gary, and CFI's CEO Ronald Lindsay authorized the funding. CFI–Indiana's Reba Wooden had requested my investigation, but I first spent several days in telephone and online research—assisted by CFI Libraries Director Tim Binga. Subsequently, CFI volunteer Steve Duerr of Indianapolis accompanied me over three days of traveling and interviewing. Thanks are also due to Steve's wife Sue and mother Shirley for comfortable accommodations, and I am grateful to Pat Beauchamp, Paul E. Loynes, and other staff members for help in various ways, especially Tom Flynn for technical audio-visual analysis.

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[THINKING ABOUT SCIENCE MASSIMO PIGLIUCCI

Massimo Pigliucci is professor of philosophy at the City University of New York, a Fellow of the American Association for the Advancement of Science, and coeditor (with Maarten Boudry) most recently of *Philosophy of Pseudoscience: Reconsidering the Demarcation Problem.* His essays can be found at rationallyspeaking.org.

The Epistemology of Thought Experiments, Part 1

Imagine you are in a cabin inside a ship, without windows to look outside, so that you don't know whether the ship is moving or not. You throw a ball in the air, and it lands exactly in the position you let it go from. You then realize that you have no way to tell whether the ship is moving or not just by consideration of the behavior of the objects inside your cabin, including the ball you have been throwing: the ball behaves in the same way whether the ship is moving or not.

This, of course, is Galileo's famous *thought* experiment that logically disproved the Aristotelian prediction that the ball should fall at a distance from the throwing point, proportional to the speed of the ship (if you don't have a ship handy, you can do the *actual* experiment on a train). It seems like this and many other thought experiments—in both science and philosophy—are telling us something new about the world without having to perform physical experiments. They are examples of *a priori* knowledge about the way the universe works. How is this possible?

That is the fascinating topic of a nice paper recently published by Hayley Clatterbuck in the *European Journal of Philosophy of Science* (online on June 14, 2013), which focuses on the epistemology (i.e., how do we know things) of thought experiments.

At first sight one may not see what the big deal is: after all, don't we gain new knowledge all the time in mathematics? Doesn't that count as *a pri-*

ori knowledge too? For instance, we didn't know about certain properties of non-Euclidean spaces, but we discovered them by geometrical-mathematical analysis. Why should thought experiments be any different? And yet, the comparison just seems too weird to let it slip unexamined.

There are at least three accounts that try to make sense of how thought experiments work: they may represent an example of Platonic knowledge; they may be a pictorial form of standard inductive arguments; or they may represent a special type of induction.

Let's start with the seemingly outlandish suggestion that thought experiments give us access to a Platonic realm of ideas, so that we can somehow gain *a priori* knowledge about the physical world in just the way we gain mathematical knowledge. The argument in defense of this position is put forward by philosopher James Robert Brown, and Clatterbuck reconstructs it this way:

Premise 1. Mathematical Platonism is true.

Premise 2. Mathematical Platonism entails that numbers are outside of space or time.

Premise 3. Mathematical Platonism entails that we can have intuitive knowledge of numbers.

Premise 4. Realism about laws is true.

Premise 5. Realism about laws entails that laws of nature are outside of space and time.

Premise 6. If we can have intuitive knowledge of numbers which are outside of space and time, then we can also have intuitive knowledge of laws which are outside of space and time.

Conclusion: We can have intuitive knowledge of the laws of nature.

To unpack: Brown assumes two controversial positions in metaphysics: mathematical Platonism (the idea that numbers and other mathematical structures are real in an observer independent way) and realism about laws of nature (the idea that laws of nature are not just human constructions to make sense of the world). From these two premises, and from what they logically entail, Brown arrives at the conclusion that we can gain intuitive knowledge of the laws of nature, and suggests that thought experiments are one way to obtain such intuitive knowledge.

The argument outlined above is valid (i.e., it is structured in a logically correct way): if the premises are true, then the conclusion must follow. So, obviously, if one is inclined to reject the conclusion, one has to look critically at the premises.

Most scientists, I wager, would have no problem with P4, and therefore must accept also P5. P2 and P3 are tightly connected with P1, so the latter may be the obvious target of criticism. But, as it turns out, a large number of mathematicians and philosophers of mathematics do not find mathematical Platonism to be a bizarre idea at all (see a recap about it at http://goo.gl/zj9hSq). It is, of course, hard to imagine how one can *prove* such an idea, but then again it is also hard to imagine how one can prove that the laws of nature are outside time and space. I, for one, am happy to provisionally accept mathematical Platonism and see where this all leads.

The real stumbling block—as pointed out by Clatterbuck in her paper—is actually P6: this premise embodies an argument from analogy, whereby mathematical truths are taken to be of the same fashion as physical laws. This is metaphysically questionable, since mathematical truths are necessarily true, while physical laws appear to be only contingently true (i.e., in no conceivable universe does a given mathematical truth becomes untrue, while there are conceivable universes where our natural laws do not hold). Another way to put the point is that we routinely arrive at mathematical (and logical) truth simply by thinking about a mathematical (or logical) problem, but we usually need observations and/or experiments to gain any knowledge of the physical world—and this is because the latter is a contingent subset of a number of logically possible worlds, a subset that can only be pinpointed by observation.

(Next time: thought experiments as inductive arguments, stay tuned.) ■

There are at least three accounts that try to make sense of how thought experiments work: they may represent an example of Platonic knowledge; they may be a pictorial form of standard inductive arguments; or they may represent a special type of induction.

We inadvertently reran Massimo Pigliucci's January/February 2014 column in our March/April 2014 issue. Herewith we run the correct column. Our apologies to Massimo Pigliucci and to our readers. —The Editors

Sheaffer's "Psychic Vibrations" column has appeared in the SKEPTICAL INQUIRER for more than thirty years; its highlights have now been published as a book (Create Space, 2011). Sheaffer blogs at www.BadUFOs.com, and his website is www.debunker.com.

Earthquake Lights Shine Again!

In the first few days of this New Year, skeptics and others on Facebook excitedly shared stories about supposed "earthquake lights" finally being proven. Tectonic strains from such lights, it is said, might explain many reports of UFO sightings. Brian Dunning of the *Skeptoid* podcast remarked that a number of his supporters contacted him, suggesting that he'd have to revise his earlier skeptical comments about earthquake lights now that they have been proven to be real.

You wouldn't know it from what people are saying, but there is nothing new in this. Such claims have been circulating for decades. The "tectonic strain" theory is nothing new. It was first popularized in the 1970s by psychology professor Michael Persinger of Laurentian University in Ontario. Persinger claims that tectonic strain correlates well with not only waves of UFO sightings but other "Fortean events" as well. He explains that intense columns of electromagnetic (EM) energy may cause objects to move about in a manner suggesting "poltergeist activity," while as the electromagnetic intensity increases we might see what are described as "animal mutilations" or hear of people mysteriously being electrocuted, giving rise to reports of spontaneous human combustion. Alternatively, he argued that the EM fields generate hallucinations in the temporal lobe, based on images from popular culture, of alien craft, beings, communications, or creatures. Persinger's "correlations" between earthquakes and anomalous sightings were so loose that minor earthquakes hundreds of miles away, months previously, could be cited as causal factors.

More than twenty years have passed since this claim was made; the proof still eludes us, yet the story surfaces again. Like Jeane Dixon, "earthquake lights" are rubber duckies—always popping back up after they have been dismissed.

Most of the recent excitement refers back to news stories reporting uncritically on a paper in *Seismological Research Letters* by Robert Thériault, France St-Laurent, Freidemann Freund, and John S. Derr (http://goo.gl/wOsXnp). I wrote about Derr in my "Psychic Vibrations" column back in the Fall 1992 SKEPTICAL INQUIRER:

> Elsewhere on the UFO front, geophysicist John S. Derr got much public attention this past April when he told the Seismological Society of America that some UFO sightings may be caused by impending earthquakes. Tectonic strain, says Derr, may cause luminous phenomena, known as earthquake lights, which can be manifested as a strange glow in the sky or even as mysterious-looking balls of electricity that float in the air near fault lines. Working from a computerized list of UFO sightings, after supposedly eliminating objects that were explainable in other terms, he claims to have found a correlation linking UFO sightings with the epicenters of future earthquakes.

More than twenty years have passed since this claim was made; the proof still eludes us, yet the story surfaces again. Like Jeane Dixon, "earthquake lights" are rubber duckies—always popping back up after they have been dismissed.

One widely cited story was "Bizarre Earthquake Lights Finally Explained," *National Geographic Daily News*, January 6, 2014 (http://goo.gl/JDMkWV). It contains a famous photo, said to have been taken in Tagish Lake, Yukon Territories, in either 1972 or 1973. What? We don't know for sure when that photo was taken? Then exactly how do we know these are supposed "earthquake lights"? Well, according to the electronic supplement to Thériault et al. (http://goo.gl/BNU4fy),

> At the beginning of the 70's, around 10 am on a Canada Day (1st of July) long weekend, a couple boating on the Taku Arm of Tagish Lake, southern Yukon, saw 7 yellow luminous globes on the nearby flank of Lime Mountain . . . in the early 70's, the only years when Canada Day occurred on a weekend is in 1972 and 1973. In both years, a strong earthquake happened in July.

Okay so an earthquake occurred that month. Good enough.

> Of the two, the most likely candidates that could be linked with the observed globes of light is the Cross Sound earthquake (ML 6.7), as it happened on the 1st of July 1973 at 06h33 LT, hence just a few hours prior to the EQL [earthquake light] sighting (if we assume that the latter were effectively seen on that day). This earthquake was followed the same morning by two aftershocks, first an ML 5.2 earthquake at 08h12 LT, followed by a ML 4.1 earthquake at 09h03 LT (AEIC, 2012).

If we accept the best-case result (July 1, 1973), the epicenter of that undersea earthquake was approximately 160 miles from where the photo was taken, three and a half hours later. So "earthquake lights" don't really need to be anywhere near earthquakes, neither in time nor in space! I changed the contrast and brightness on that photo (no Photoshopping). That bottom light is in front of the trees! Oops.

Supposed "earthquake lights" in Tagish Lake, Yukon Territories.

Supposed "earthquake lights" in Sichuan YouTube video are actually iridescent clouds.

Another widely-shared story was "Why Do Lights Sometimes Appear in the Sky During An Earthquake?" on Smithsonianmag.com (http://goo.gl/3yGzzD). It contains a YouTube video of supposed "earthquake lights" seen thirty minutes before the 2008 earthquake in Sichuan, China. Anyone familiar with meteorological optics will immediately recognize that these are *iridescent clouds*, a diffraction phenomenon caused by water droplets or ice crystals in clouds. It has nothing to do with geology or earthquakes. Phil Plait, the Bad Astronomer, wrote a recent column on iridescent clouds (http://

goo.gl/wTPYUb). On BeforeItsNews, we read "'Earthquakes Lights' [sic] Considered Real Phenomena" (http://goo.gl/QSqJCg). It contains photos of supposed "earthquake lights" from San Diego, California, and Santiago, Chile. These are also photos of iridescent clouds. One would expect that if earthquake lights were real, their proponents would offer up better photos than these.

In 2007, Kentaro Mori's excellent Blog *Forgetomori*, from Brazil, posted a story about possible earthquake lights in Peru, followed soon afterward by the suggestion that these were very likely flashes from electrical transformers shorted out by the earthquake (http://goo.gl/hPsvAz). Frankly, they look like they could also be lightning flashes. It's truly remarkable how mutable "earthquake lights" are. Sometimes they look like small globes climbing up a mountain. Sometimes they look like flashes of lightning. Other times they look exactly like iridescent clouds. Earthquake lights can look like anything at all when you are avidly seeking evidence for them.

The "Electronic Supplement" to the paper by Thériault et al. reads like just about any collection of UFO reports (http://goo.gl/BNU4fy). People see lights they cannot explain, and this gets turned into something amazing. One thing to keep in mind: looked at on a worldwide basis, earthquakes are quite a common phenomenon, although of course they are not distributed uniformly. On average, there are about 134 magnitude six earthquakes each year, or about one every three days. Of magnitude five, there are something like 1,319, and so on, increasing by about a factor of ten each step as we descend the ladder. This is because the magnitude scale of earthquakes is exponential: A magnitude six earthquake releases ten times as much energy as one of magnitude five, and so on. One criticism that has often been applied to claims of ESP is that it does not seem to be related to distance, shielding, etc., which generally runs counter to physical phenomena. A remote viewer can supposedly view something in a distant submarine as easily as in the next room and can view the future as well as the present or past. That same criticism applies to earthquake lights as well. A small earthquake, or one hundreds of miles away, or one hours or days in the past or future, produces earthquake lights just as easily as a major earthquake right here, right now.

"The globe of light was seen 11 days prior to the foreshock of the Saguenay earthquake series." So, earthquakes still eleven days in the future (and presumably eleven days in the past as well) can produce light globes. And how long is it from the foreshock to the earthquake? Double that interval (before or after), then add it in. How many earthquakes occur globally during that interval?

A "tremendous flash in the sky" was reported during a Magnitude 3.7 earthquake, which results only in minor shaking. This earthquake releases only .001 as much energy as a 6.7 quake. With over 100,000 magnitude three-point-something earthquakes occurring per year, so long as your sighting is somewhat near an earthquake fault, there should be no difficulty finding an earthquake to "explain" it. The magnitude 5.2 earthquake in Waynesville, North Carolina, of 1918 is linked to the famous Brown Mountain Lights (#7), long reported and long debunked by skeptics. (See Philip J. Klass's *UFOs Explained*, Chapter 7).

I am not saying that it is impossible that there could be such a thing as "earthquake lights." What I am saying is that I have not seen any convincing proof that such things exist.

I am not saying that it is impossible that there could be such a thing as "earthquake lights." What I am saying is that I have not seen any convincing proof that such things exist. I am aware that there exist copious anecdotal accounts of earthquake lights. I am also aware that there exist copious anecdotal accounts of supposed extraterrestrial spacecraft, angels, Bigfoot, etc. Until solid evidence is presented, I will regard all of these as highly dubious. The bottom line for "earthquake lights" is: *You cannot ground a theory in physics on uncorroborated eyewitness testimony about lights in the sky*.

For several years, my backyard faced a mountain where the San Andreas Fault ran in the valley on its other side no more than two or three miles away. I would often go outside to look at stars, but I never saw any earthquake lights. I figure that if they would be seen anywhere, they would be seen there, and not some place hundreds of miles from a fault. ■

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Health Risk from Fukushima Radiation

Fear is a powerful emotion with clear protective functions. However, fear is not always adaptive. An emotion that evolved to protect our ancestors (chiefly from threats such as large predators) now is pressed into service in a complex technological civilization. The number of things we are told to be frightened of on a daily basis—by the news media, social and ecological activists, and others—is overwhelming.

Fortunately we have other tools to help us navigate the dangers we face, such as logic and evidence. These can help us put our fears into a proper perspective. These are all the more necessary, as the Internet has become a primary fear-spreading machine. Fear-mongering memes are the new predators in our virtual environment, and they are always ready to pounce.

Information regarding the Fukushima Daiichi nuclear power plant disaster, for example, remains widespread on the Internet. It is certainly reasonable to consider whether or not radiation from the reactors pose any health risks, but what does the evidence tell us?

A fishmonger checks large bluefin tuna before the first trading of the new year at Tokyo's Tsukiji fish market in this January 5, 2012, file photo. Bluefin tuna caught off the U.S. coast have been found to contain radioactive material from Japan's quake-struck Fukushima nuclear plant. Researchers said the elevated radioactivity posed no risk to public health as the observed levels were more than an order of magnitude lower than the Japanese safety limit and were lower than other naturally present isotopes.

AFP PHOTO / Yoshikazu TSUNOYOSHIKAZU TSUNO/AFP/GettyImages.

On March 11, 2011, a tsunami hit northeast Japan. The flooding overwhelmed the safety measures at the Fukushima Daiichi nuclear power plant, causing several reactors to experience meltdown and resulting in the leaking of radioactive contaminated water into the local environment (Marshall 2013). This has resulted in restrictions on fishing in the vicinity of Fukushima. Recent evidence also indicates that radioactive material continues to leak into the ocean near Fukushima, although in amounts much smaller than the original leak resulting from the tsunami.

The question remained, however: How far did radioactive elements from Fukushima spread, and do they represent a health risk to anyone outside of the local vicinity? In 2012, researchers reported detecting radioactive elements (cesium-134 and cesium-137) that could clearly be traced to Fukushima in Pacific bluefin tuna (Madigan et al. 2012). These tuna spawn off the coast of Japan and migrate across the Pacific all the way to the California coast, where some are caught and eaten. These fish were able to carry radioactive contamination all the way from Fukushima to dinner plates in California. This created fear that contamination from Fukushima might have been far worse than the authorities were telling us, and perhaps could be affecting environments all over the world. This fear was also spread through conspiracy-theorist bloggers who claimed that the Japanese and American gov-

ernments were engaging in a sinister collaboration to hide the truth from American fish consumers.

Toxicity, however, is all about dose, even with something as seemingly dangerous as radiation. A follow-up study published in the *Proceedings of the National Academy of Sciences* (Fisher et al. 2013) found that the levels of radioactive contaminants found in Pacific bluefin tuna were negligible:

"The additional dose from Fukushima radionuclides to humans consuming tainted PBFT in the United States was calculated to be 0.9 and 4.7 μSv for average consumers and subsistence fishermen, respectively. Such doses are comparable to, or less than, the dose all humans routinely obtain from naturally occurring radionuclides in many food items, medical treatments, air travel, or other background sources." The advantage of communicating the relative risk of radiation exposure is that there is a certain background "natural" exposure that is unavoidable. When levels of exposure are less than this background, it is easy to make the point that any risk is insignificant.

The World Health Organization (WHO) has also reviewed the data concerning the radiation leaked, in all forms, from the Fukushima disaster. Most of the radiation was leaked in the week following the accident, but there have been continued leaks since then, mostly through ground water. The WHO review concluded: "A breakdown of data, based on age, gender and proximity to the nuclear plant, does show a higher cancer risk for those located in the most contaminated parts. Outside these parts—even in locations inside Fukushima Prefecture—no observable increases in cancer incidence are expected" (World Health Organization 2013). An independent 2013 review also found little evidence of any significant radiation outside the immediate area of the accident: "It is important to note that all of the radiation levels detected outside of Japan have been very low and are well below any level of public and environmental hazard" (Thakur et al. 2013).

Even bluefin tuna spawning off the coast of Japan have negligible levels of contaminants and pose no risk to human health. This is all good news, but the environmental and health effects of Fukushima, which is an ongoing disaster, will need to be monitored for some time.

Recent estimates are that water contaminated with radioactive elements is leaking from Fukushima into the nearby ocean at a rate of 300 tons per day (Kimura and Kawada 2013). This sounds like a lot, but the Pacific Ocean contains 714 million cubic kilometers of water. Simple dilution is reducing the concentration of radioactive contaminants below the level where there is any health risk, to sea life or to those consuming seafood. There does remain concern for the immediate vicinity, of course. For this reason Japan has banned fishing along the coast near Fukushima.

Conclusion

The Fukushima Daiichi disaster resulted in serious environmental contamination with radioactive contaminants. However, the contamination is mostly limited to the vicinity of Fukushima. Monitoring of contaminants in the Pacific, North America, and around the world reveal that they are at very low levels, below that which would cause any health concern or even peak above background radiation exposure. Even bluefin tuna spawning off the coast of Japan have negligible levels of contaminants and pose no risk to human health. This is all good news, but the environmental and health effects of Fukushima, which is an ongoing disaster, will need to be monitored for some time. There continue to be reports of new leaks from Fukushima, so this story is not yet over (Saito 2014). Hopefully, carefully collected evidence will dominate policy and public perception. ■

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[SKEPTICAL INQUIREE BENJAMIN RADFORD

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Did Elves Delay Road Construction in Iceland?

Q: I read that there was a recent protest in Iceland involving protecting elves, or the destruction of elf habitats, from road construction. Is this real?

—D. Palm

A: The short answer is yes, but the long answer is far more interesting. In 2013 dozens of environmentalists in Iceland staged a high-profile protest against a road slated to cut through an area of volcanic rock on the Alftanes peninsula, not far from the capital of Reykjavík (Figure 1). It was only one of countless eco-protests in the world, but the campaign made international news because some of the protestors claimed that the proposed road would disturb the habitat of elves that live among the rocks.

Figure 1. Camp near the Icelandic capital of Reykjavík, where in 2013 protestors expressed concern that road construction through volcanic rock would disturb elf habitats. Photograph by Jeff Radford.

In order to understand the context of the protest, a look at the history and folklore of Iceland and the nearby British Isles is important. Elves and fairies are closely related in folklore, and though elves specifically seem to have sprung from early Norse mythology, by the 1800s fairies and elves were widely considered to be simply different names for the same magical creatures.

In the book *Icelandic Folk and Fairy Tales*, folklorists May and Hallberg Hallmundsson explain that the Icelandic conception of nature is intimately tied to its folklore of elves and fairies:

> Icelanders are generally very attached to their country, perhaps more so than most other peoples ... It is a love for the land itself in its physical presence, for its soil, mountains, streams, valleys, and even its fire-spewing volcanoes and frozen wastes of ice... To the Icelanders, the land was never just an accumulation of inanimate matter—a pile of stones here, a patch of earth there—but a living entity by itself. Each feature of the landscape had a character all its own, revered or feared as the case may be, and such an attitude was not a far cry from believing that it was actually alive. (Hallmundsson and Hallmundsson 2012, 7)

That life spirit said to inhabit the hills and streams of this island nation has come to be personified as elves and other magical beings. While it's easy to mock such folk beliefs as backward or antiquated, most cultures profess a

Figure 2. Road construction worker braves angry eco-protestors and a nithing pole curse while clearing a controversial lava field. Photograph by Jeff Radford.

The evoking of fairies and elves in the struggle to preserve natural areas not only captures the public's romantic imaginations but also taps into deep pre-existing social and cultural concerns about environmentalism.

belief in supernatural or magical beings including demons, angels, ghosts, and genies (djinn). These elves, like the fairies of early British lore, have many human qualities and may exact revenge if mistreated or disturbed. Elves and fairies are believed to live in their own separate, hidden world and generally ignore humans but must be treated with respect; to do otherwise invites anything from mischievous pranks to child abduction by elves.

Iceland has several areas semi-officially designated as "elf areas," such as small caves and rocky crags where the magical beings are said to dwell. While it would be inaccurate to suggest that all, or most, Icelanders firmly believe in the literal existence of elves, the fact is that a great many of them—at least 100,000 in this small nation of fewer than a third of a million people—express some form of belief in elves. As one Icelandic writer noted, "Surveys consistently show that [of] Icelanders...a little bit more than half of respondents will not discount the possibility outright. In a 2009 survey, only 32 percent felt comfortable discounting the idea that humanoid creatures lived inside rocks and were magic... According to a 2007 survey... only 8 percent of the population say they do believe in elves, so there are just a whole lot of fence-sitters who refuse to be pinned down on whether they do believe in elves or not" (Tulinius 2014).

Monkey-Wrenching Eco-Elves

Folklorist Andy Lechter, in his article "The Scouring of the Shire: Fairies, Trolls, and Pixies in Eco-Protest Culture," describes ecological protests involving fairies that are very similar to the controversy in Iceland:

> Fairies have inspired a counter-cultural movement. The 1990s in Britain were marked by large and dramatic public protests against a government-sponsored programme of road building, and ... opencast quarrying. A distinctive protest culture flourished in response to this, combining the politics of direct action and an anarcho-travelling lifestyle, with a definite neo-pagan sensibility. This culture adopted an important fairy mythology which placed protesters within an almost fairytale-like struggle between the benevolent forces of nature and a tyrannical and destructive humanity. (Lechter 2001)

Lechter adds, "In this animistic view, the natural world … is threatened by human encroachment. Protesters see themselves as aided by, or aiding, these nature spirits. Here, the forces of nature, which include fairies, are regarded as benign, as opposed to humanity, which is seen as malign, corrupt, and divorced from nature."

The evoking of fairies and elves in the struggle to preserve natural areas not only captures the public's romantic imaginations but also taps into deep pre-existing social and cultural concerns about environmentalism. The theme of threatening new changes and modern ways disrupting the natural order of things is universal and appears explicitly in many classic literary works. Perhaps the most famous is J.R.R. Tolkien's

Lord of the Rings saga, in which the idyllic Hobbit homeland, the Shire, is threatened by dirty, polluting industrialization at the hand of the evil wizard Saruman. The overcoming of peace and nature over threatening change is a key theme in Tolkien's books and conveys a powerful message of environmentalism.

It's easy to exaggerate the conflict and caricature the Icelandic protesters as crazy, lava-hugging environmentalists who are willing to be arrested to stop an imaginary elf village from being bulldozed. But disturbing the fairies is only one of several reasons offered by the protesters for why the road construction should stop; many challenge the legality of the road (the lava fields were officially protected in 2009, and may or may not remain so today), while others lament the impending destruction of a culturally significant local landmark (with or without resident elves).

In early 2014, Kári Tulinius, an Icelandic writer, expressed a widespread exasperation with the media attention about the incident. "The long answer is that it has been reported by the Associated Press, and subsequently hundreds of media outlets around the world, that opposition to a proposed road in the Reykjavík suburb of Garðabær is driven by a belief that it will disturb areas Icelanders consider to be the elf homes. The short answer is: AAAAARGH! Oh hell no! Please no questions about goddamn elves! ...The protests have nothing to do with elves" (Tulinius 2014).

This is not actually true; while Tulinius's annoyance with the whole issue (as well as flawed journalism) is understandable, he errs in overstating his case. The fact is that the protest does indeed have something to do with elves, because some of the protesters (not necessarily all, or even most of them, as widely reported) have invoked elves as a reason for their protest.

Though I was not able to travel to Iceland to research this protest personally, my father, a veteran journalist himself, happened to be in Reykjavík at the time and interviewed many of the protesters. Some expressed their sincere concern for elf safety, while others focused instead on legal issues. Ecological protests, even organized ones, are often composed of various people united for a common goal. It's not uncommon for different protesters to have different reasons for joining the group.

In fact, not only did some of the protesters invoke the presence of elven magical creatures in their fight, they actually placed a curse on the road construction crew (and, by extension, anyone else supporting the project; see Figure 2). This took the form of a nithing pole—a traditional Icelandic/German pagan device used to curse enemies. Nithing poles are traditionally topped with a freshly severed horse head, but a fearsomely toothed fish head was used instead (see Figure 3).

Some Icelanders truly believe in elves, and many do not. Some of the eco-protesters in Great Britain, Iceland, and Scandinavia are genuinely concerned about disrupting fairy villages, and some aren't. To most of them, it doesn't really matter; the important point is that the world's attention is drawn to what they see as an illegal and immoral destruction of pristine land. ■

Figure 3. A nithing pole, using a fish head instead of the traditional horse head, erected by eco-protestors to curse those building a road through a protected area of volcanic rock said to house elves. Photograph by Jeff Radford.

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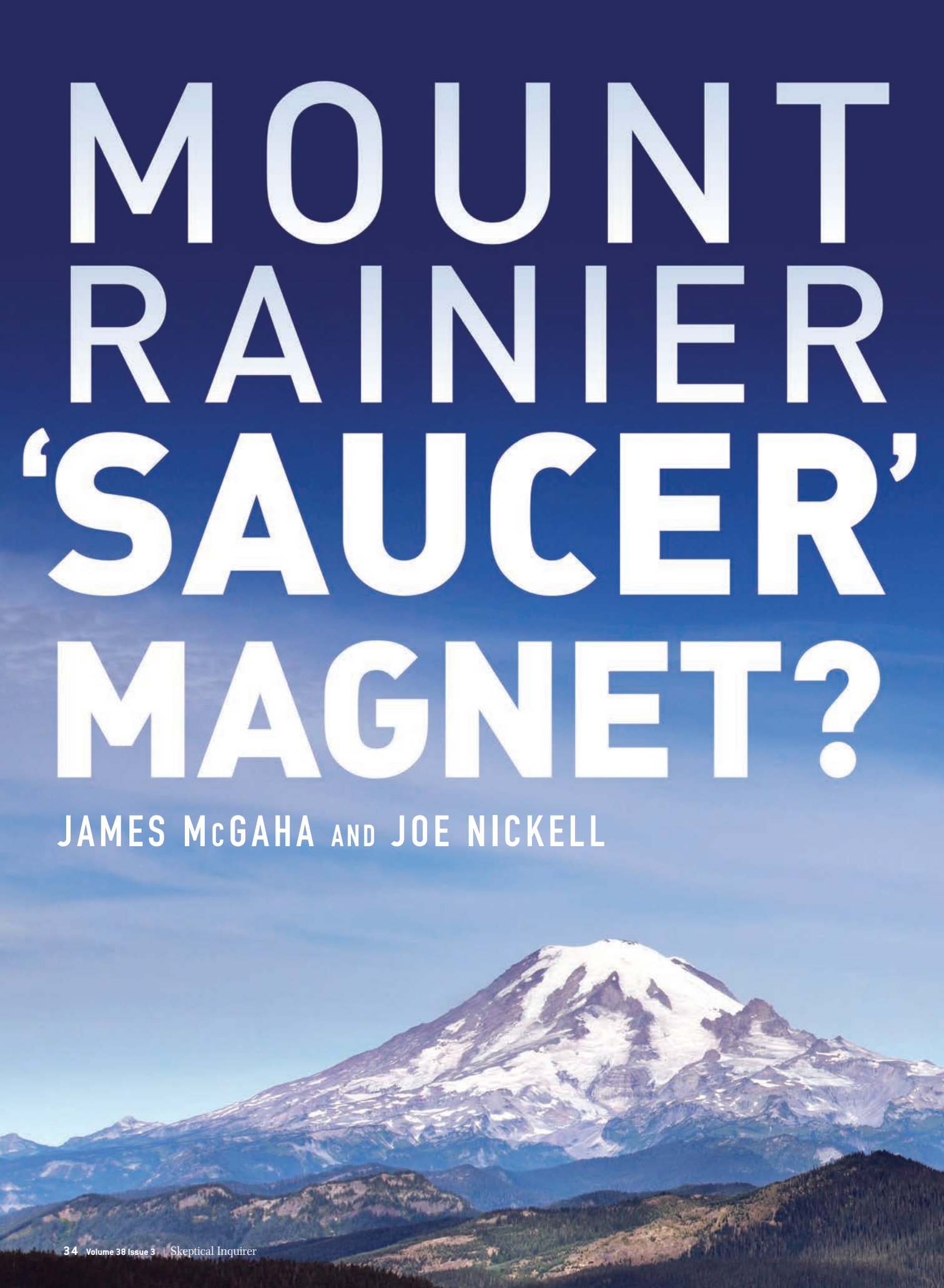
MOUNT RAINIER 'SAUCER' MAGNET?

JAMES McGAHA AND JOE NICKELL



Mount Rainier isn't just where seminal UFO figure Kenneth Arnold saw "flying saucers" in 1947; the majestic mountain actually plays a more direct role in saucerology.

Majestic Mount Rainier in Washington's Cascade Mountains seems to attract—even help produce—flying saucers. During a few days in October 2013, one of us (Nickell) was able to twice fly over and even walk upon and explore the rarified slopes (at over 5,500 feet) of the still active volcano. Here we put our heads together to look at Mount Rainier's continuing role in the history of UFOlogy.

Mirage Saucers

As students of saucerology know, private pilot Kenneth Arnold famously saw nine "flying saucers" in an echelon pattern over the Cascade Mountains in the vicinity of Mount Rainier on June 24, 1947.

Arnold's UFOs have been variously interpreted: airplanes flying in formation, a flock of American white pelicans, balloons, even droplets of water on his airplane's windshield. However, one of us (McGaha, in Nickell 2007, 15–16) has hypothesized that it is more likely the several culprits were optical phenomena called "mountain-top mirages."[1]

This phenomenon, as shown in photographs (e.g., Menzel 1953, 212), gives the appearance of hovering, saucer-shaped craft. Due to the conditions that produce a mirage, it is the mountain tops themselves that appear in artificial suspension above the landscape.

Given the clear skies and smooth air in which Arnold saw the flying saucers, together with the angle of the sun (50.4 degrees above the horizon), all that was needed was a *temperature inversion* to complete the formula. Normally, air becomes colder with the increase in altitude. Sometimes, however, the situation gets reversed. For example, the ground cooling rapidly at night can cool the air directly over it, and since the layer above that is naturally warmer, the result is a temperature inversion. This causes light rays that pass through the air to bend, with images thus becoming distorted and, in the case of mountain-top mirages, also appearing *displaced* (Sachs 1980, 321).

Arnold's own statements about his sighting help to bolster the case for just such mirages being responsible. He said the objects appeared to reflect sunlight and that they even seemed like "reflections" (as from his plane window, which he checked and ruled out). Indeed, "the flashing they made in the sun reminded me of the reflection of a great mirror," he said, and they "looked like they were rocking" (Bequette 1947). The entire effect would have been enhanced by the position of the sun, its light reflecting off the upper surface of the mirages. He stated that, in addition the "saucer-like" objects were "flying very close to the mountain tops," seemingly "swerved in and out of the high mountain peaks," and, he came to conclude, were a formation "in the neighborhood of five miles long"—a large squadron indeed! He saw them—he calculated from "two definite points," Mount Adams and Mount Rainier—as being 100 miles away, and he got as close to them as twenty-three miles (quoted in Bequette 1947; Clark 1998, I: 139–43).

Mount Rainier was not directly part of the mirage, which was caused by other mountains in the Washington Cascade range, but Arnold did describe the "saucers" as flying approximately south from Mount Baker in the direction of Mount Rainier (Clark 1998, I: 139). Therefore, we characterize the latter as, metaphorically, a "magnet" for UFOs.

Mountains like Mount Rainier actually help to form clouds into the shapes of flying saucers! Called lenticular ("lens-shaped") clouds, these smooth, symmetrical formations may take the simple form of a double-convex lens, or they may be much more elaborate, piled into a stack of two or more, as if with a spaceship's undercarriage below.

Holy Mount

On the anniversary of Kenneth Arnold's sighting, states one UFO writer, "ufologists make the trek to Rainier to commemorate the birth of saucerology." He might have replaced "trek" with "pilgrimage," since he seems to elevate the mountain to the status of an Olympus or a Sinai. He lists Rainier as one of several UFO "hotspots," that is, "Areas of concentrated UFO activity that can be treated by UFOlogists as 'UFO laboratories'" (Glenday 1999, 120, 123).

Yet apart from the Arnold sighting, he lists for the Rainier area only "the infamous 'Maury Island' incident, in which a dog was killed and a boy injured by debris discharged by one of six UFOs" (Glenday 1999, 123). Arnold was involved in that 1947 case as well, but as a supposed investigator. He was out of his depth, and it fell to Air Force investigators to expose the case as a hoax, confirmed by confessions of the perpetrators (Clark 1998, 2: 612–14).

Now, Mount Rainier actually plays a more direct role in saucerology, helping indeed to generate what Hendry (1979, 65) calls "saucer-like apparitions"—a striking phenomenon whose secrets we take up next.

Rainier as a Saucer Creator

Mountains like Mount Rainier actually help to form clouds into the shapes of flying saucers! Called lenticular ("lens-shaped") clouds, these smooth, symmetrical formations may take the simple form of a double-convex lens, or they may be much more elaborate, piled into a stack of two or more, as if with a spaceship's undercarriage below. Such clouds may appear singly, or in groups resembling a squadron of flying saucers (Sachs 1980, 66).

These cloud saucers are seen in and around mountainous areas. They are

formed when stable moist air flows over hills or mountains, causing large standing waves to form on the prominence's downwind side. Should the temperature at the crest of a wave drop to the dew point (the temperature at which vapor condenses) a lenticular cloud may be formed. (Rarely, lenticular clouds may form where no mountain exists, when a front causes shear winds.) Lenticular clouds typically remain stationary and have long durations (Hendry 1979, 65; "Lenticular Cloud" 2013).

A beautiful array of layered clouds was photographed for instance over Sao Paulo, Brazil, with a mountain range in the distance (Sachs 1980, 66). More relevant to the present discussion, another source points out that on some days Seattle, Washington, "is treated to an unusual sky show when lenticular clouds form near Mt. Rainier," which looms less than one hundred kilometers to the southeast ("Astronomy" 2009).

Lenticular clouds can actually be reported as UFOs. Investigator Allan Hendry (1979, 65) cites a case involving confusion over these saucer lookalikes, "in which five to six lenticular clouds hung stationary over Peavine Mountain for half an hour in Reno, Nevada," then "descended into a conventional cloud layer." Moreover, like airplanes, weather balloons, planets, "shooting stars," and other aerial phenomena, these cloud formations are subject to atmospheric distortion—caused, for example, by intervening fog, ice crystals, whirlpools of air, and the like. The resulting distorted image may appear especially saucerlike (Sachs 1980, 201). It is possible that among the UFO cases that remain unsolved a few could involve lenticular clouds, possibly viewed under unusual conditions.

One of us (Nickell) spotted a single lenticular cloud hovering right over the top of Mount Rainier. He was riding in a shuttle to the Seattle airport with physicist and CFI board member Leonard Tramiel (the day after the CFI Summit, a conference in Tacoma, October 24–27, 2013). Some fellow passengers at first thought it was just the mountain's snowcap, but Leonard confirmed it was indeed a lenticular cloud. Mount Rainer was then obscured by trees and buildings for the next few minutes and, when it next came into view the cloud was gone. Or, as Leonard happily quipped, "It flew away!"

Lenticular clouds over Mount Rainier

Airship Visit of 1896

We turn now to a mysterious UFO sighting at Mount Rainier that occurred half a century before Arnold's saucers heralded the wave of modern UFOs. It was reported by a couple who described a strange light in the night sky near the summit of the famous mountain. Their account is related in books like *Weird Washington* (Davis and Eufrasìo 2008, 73), but, as one might imagine, there is more to the story.

The original account appeared in the *Tacoma Daily Ledger*, November 27, 1896, p. 4, under the heading, "What was it? Wonderful apparition seen over Tacoma." It informs that on the previous Tuesday (November 24) at about twelve o'clock at night, druggist George St. John and his wife were lying abed and saw from their Tacoma Avenue window a strange light "east of Mount Tacoma" (now Rainier). "Mr. St. John," the newspaper reports, "describes it as having the appearance of a brilliant electric light and looked to be nearly the size of an arc electric light. It flashed often and each time sent forth various colored rays of light, shooting out from the center in every direction, like spokes from the hub of a wheel." The couple watched the light as it moved slowly from one window to another. The account continued, "It seemed to have a wavering motion and swayed back and forth in its course through the heavens like a vessel at sea in a storm."

It is important to note that this report came amidst the great wave of "airship fever" that occurred in the United States between November 17, 1896, and the middle of May 1897. Fueled by science fiction interest in the possibility of heavier-than-air flight, the rash of sightings began when something resembling an "electric arc lamp" passed over Sacramento, California, in the early evening of November 17, 1896. Significantly, this was during the annual Leonid meteor shower (its peak in 1896 was on November 14), suggesting it was a large, bright meteor known as a *fireball*. Newspapers hyped the story, prompting people to look to the

skies, and soon almost anything seen in the heavens was thought to be another "airship" sighting (Nickell 1995, 190–192; Bartholomew and Howard 1998, 21–79).

What caused the Rainier light display? We considered a number of possibilities, from the remote to the plausible. We were doubtful of its having been a copycat hoax (the witnesses were aware of the Sacramento event but were considered reputable) ("Seen at Tacoma" 1896). For a variety of reasons, we doubted the possibility of a shared hypnagogic ("waking dream") experience, although such hallucinations between wakefulness and sleep often involve bright lights and visions (Mavromatis 1987, 14–52). We thought of ball lightning, other unusual forms of lightning, and electrical discharges such as St. Elmo's Fire (Corliss 1995, 17–55), but they are rare and seem inconsistent with the apparent weather conditions in Tacoma at the time. A scintillating ("twinkling") star could have produced some of the effects (a planet can scintillate too), but it would have taken a very long time to have moved from one window to another (see Nickell 2012; Hendry 1979, 26).

Because the St. Johns' experience occurred during the Alpha Monocerotids meteor shower (which peaked on November 21), we considered that the "flashes" the couple reported were possibly *meteors*, the arc light effect a very large meteor called a *fireball*, and the radiating colors possibly caused by a *bolide*, "a bright shooting meteor (fireball), especially one which explodes when it is near the end of its path in the atmosphere" (Mandel 1969, 61). However, this scenario, too, seemed an ill fit with portions of the witnesses' description. Again, what was the "airship"?

Analysis

The *San Francisco Call* of November 28 had more information. The couple "watched the heavenly stranger over half an hour." Reported the newspaper: "Mr. St. John says that the varicolored lights were shot forth in all directions. They were emitted from each end and both sides" of the supposed airship. "Some of the lights were white, others red, blue and green. . . . When all the lights were shining the aerial monster seemed encased in a brilliant glow. . . ."

A scintillating ("twinkling") star could have produced some of the effects (a planet can scintillate too), but it would have taken a very long time to have moved from one window to another.

Significantly, the newspaper noted, "The moonlight was not strong enough to permit a distinct view of Mount Tacoma [Rainier], but the airship was seen to approach the neighborhood of the mountain at what seemed to be its exact height, and dart hither and thither as if an exploration was in progress." At length, the couple tired of watching the scene—suggesting it may have been less dramatic than we might otherwise have imagined—"and went to sleep" ("Seen at Tacoma" 1896).

The radiating colored lights scarcely seem consistent with an imagined airship, or even, for that matter, an extraterrestrial craft. Rather, it seems like *something* that had an oblong shape (with ends and sides) was hovering, glowing with a bright white light while occasionally rocking in place and causing diffraction of the light, thus producing iridescent colors.

We think this *something* near the summit of Mount Rainier was most likely a lenticular cloud—forming and reforming itself in place (as such clouds do) and consisting largely of ice crystals. These crystals served to diffuse the light from the moon (which at that date and time would have been above and behind the cloud,[2] at an angular distance of 35 degrees), causing it to glow. As it shimmered in place, it sometimes flashed and sometimes emitted colored rays. It is also quite possible that there were multiple lenticular clouds. (We should mention that the St. Johns' nineteenth-century windows would have consisted of a wavy glass that, covered lightly in frost, could itself have produced some of the effects.) (For a discussion of all these light phenomena, see Minnaert 1974, 232–45.)

According to an authoritative source (Dunlop 2003, 94–95, 108–109), iridescence is among the most common yet most overlooked of optical phenomena. That produced by moonlight, while often more visible, is largely ignored. Iridescence appears "as bands of color around the edges of thin clouds," including *altocumulus*, *altostratus*, and *cirrocumulus lenticularis*. It is often strongest when the light source is an angular distance of 30–35 degrees. Significantly, the moon on the date and time of the St. Johns' experience was at *35 degrees* and was 78 percent illuminated.

Conclusions

As we trust this discussion illustrates, mysteries dart about Mount Rainier and the other mountains of the Cascade range. But mysteries are meant to be solved, and the scientific approach—which seeks to explain rather than hype or dismiss—is the best means to that end. ■

Acknowledgments

We are grateful to CFI librarian Lisa Nolan for much helpful research, and SI typesetter Paul Loynes for patience during many revisions.

Notes

1. Menzel (1953, 205–24) provides detailed explanations of the physics and optics of mirages. See also his appendix, "Theory of Mirages," 300–10.

2. From the St. Johns' viewpoint, the summit of Mount Rainier was at less than 4 degrees from the horizontal, while the moon on the date given was at 35 degrees. It was 78 percent illuminated.

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STOP HEISENBERG ABUSE!

Three Outrageous Misappropriations of Quantum Physics

Parapsychologists, academics, and religious figures are all guilty of misusing the ideas of quantum mechanics to bolster their own thoughts. How did these distortions become so popular, and how can we make the public more aware of the rigorous but exciting science underneath?

DALE DEBAKCSY

We have been living in a quantum world for over a century now, and in that time quantum mechanics has grown from a field hesitantly understood by a handful of men into a full-fledged intellectual industry. Unfortunately, where ubiquity treads, misrepresentation soon follows, and no branch of science this side of evolutionary theory has suffered more distortion from popularization than quantum theory. Trendy parapsychologists, academic relativists, and even the Dalai Lama have all taken their turn at robbing modern physics of a few well-sounding phrases and stretching them far beyond their original scope in order to add scientific weight to various pet theories.

It's time to set the record straight on the most egregious of these abuses, a task rendered more difficult by those well-meaning physics writers who try to make quantum mechanics sexier for the casual reader. As a physics teacher myself, I've been guilty of this more than once in the classroom. "Quantum physics is, like, anarchy, man. No rules! Down with Newton!" pretty well sums up the trend. But this puts the kaboom in the wrong place—quantum mechanics is revolutionary and exciting and breathtaking, but only after a lot of painstaking mathematics has been worked through, and a lot of rules followed. It's in the disregarding of those rules that miscarriages like the following three Big Lies come into being.

01 LIE ONE:

"Quantum physics says that mind determines reality, and therefore that Buddhism is right."

The Argument:

Take an electron and put it in the center of a box. Now replicate that set up a hundred times. If you were to perform a position measurement on the particle after one second in each box, what you would most likely get is a hundred different results. Not because the particle is randomly veering about like a little billiard ball but because the act of measurement imposes a position upon what was previously a complex object of indeterminate location. The measurement created the position. And so, because observation changed the nature of the system, reality is fundamentally a construct of observation, and our minds, which we use to observe the world, are thus the creators of reality. As such, our true minds must not be part of physical reality themselves but rather must be objects in a higher realm of existence, a realization that drags with it the whole corpus of Buddhist principles.

Why It's Wrong:

Oh so many reasons. The cardinal sin, however, is that of conflating well-defined scientific terms with loosely understood popular ones. So, "measurement" becomes "observation" becomes "thought" becomes "mind" in a chain of ever-decaying precision that admits a correspondingly ever-widening array of wishful thinking to be passed off as science.

This is what we know: If you give me a particle and describe its environment carefully, I can craft a mathematical object, called a wave function, for you. By manipulating it, you can tell how likely it will be for a certain measurement to yield a certain result. If you make a position measurement, the wave function can be used to tell you the probability of finding your particle at, say, location x=4 at time t=3.

What a measurement does is collapse the often ludicrously complicated wave pattern of a particle to a spike centered on one of the possible values allowed by the wave function. So, your measurement can't result in just *any* answer. It's like having a hundred pieces of paper, each with an even number on it, dropped into a hat. When you reach in, you're going to pick out an even number. No matter how hard you think about it, you'll never pull out an odd, and you will never be one

hundred percent sure what the next number you are going to pull will be (unless they're all the same number, in which case you're sort of extraneous to the whole process, aren't you?).

A measurement just spins a weighted wheel of predetermined allowed values, and spits out one of them. For the experimenter, the experience is more akin to reading a ticker-tape produced by a deranged monkey typist than "willfully creating reality."

But that's not the worst of it, because the argument totally ignores the rather titanic issue of scale. Put simply, quantum effects stop being observable when the particles involved rise above a certain size. It's actually a fun calculation, and one of the few in quantum mechanics you can do without a couple years' worth of calculus, differential equations, and linear algebra in your hip pocket. Quantum effects are typically observed when a particle's wavelength is bigger than the size of the system the particle lives in. Temperature also plays a role; the colder it is, the more quantum effects tend to be relevant. This is all wrapped up in the formula

$$\lambda = \frac{h}{\sqrt{3mk_BT}}$$

where λ is the particle's wavelength, h is Planck's constant, k_B is Boltzmann's constant, m is the mass of your particle, and T is the temperature of the system. For an electron, zooming around a bar of aluminum, the size of the system is about 4.05×10^{-10} meters (the distance between aluminum atoms). At a room temperature of 298 Kelvins, we get $\lambda = 6.25 \times 10^{-9}$ meters for the electron, and so indeed, electrons behave in a "quantum" manner under normal circumstances, and therefore our measurements will collapse their observable quantities down in a way consistent with the wave equation's probabilistic predictions.

However, for one of the aluminum nuclei in this system, with a mass millions of times greater than that of the electron, quantum effects don't manifest until the temperature drops to .001 K, i.e., a thousandth of a Kelvin above *absolute zero*. Experiments like this are being done (See, for example: http://www.nature.com/nnano/journal/v7/n5/full/nnano.2012.34.html), using lasers to drop the energy, and therefore temperature, of particles down to the level where quantum effects are observable even on the molecular level. However, when it comes to day-to-day, dude-in-his-room-meditating existence, we're really talking only about particles around the mass of an electron exhibiting anything like the finickiness toward measurement that we come to expect from quantum mechanics.

Measurements do impact systems, and the mechanism behind that impact is still incompletely understood. And yet the impact of a measurement is far less dramatic than what quantum Buddhism would have us believe. Its "reality-creating" aspect is only in evidence for subatomic particles (or extremely cold small atoms), and even then it isn't so much creating reality as selecting one of several predetermined possible states. And none of it has anything to do with consciousness or mind or any other human attribute that sounds kind of sort of like "measurement."

At best we can say, "Measurements randomly select values." But that is indeed a far cry from "Mind creates reality."

02 LIE TWO:

"Quantum entanglement means that precognition and telekinesis probably exist."

The Argument:

In the phenomenon of quantum entanglement, pairs of particles are seemingly able to transmit information to each other faster than the speed of light. The classic example is that of a decaying pi meson particle breaking up into an electron and a positron. The spin of the original meson was zero and, in order to conserve angular momentum, that must be the sum of the resulting particles' spins as well. What we have found is that, no matter how far away the two particles are, when I measure the spin of, say, the electron, the spin of the other particle is simultaneously fixed as well. So, if the electron is spin *up*, the positron will be spin *down*. Before the measurement, the electron had no definite spin (remember, the act of measurement selects the value that actually manifests in reality), but the instant that it is measured and a spin sign is obtained, somehow the other particle "senses" it and changes itself accordingly to preserve angular momentum.

Based on this finding, then, certain popular writers in the parapsychological community have theorized that it is the scientific mechanism behind precognitive abilities.

The reason that one person can sense things about a person thousands of miles away, they explain, is that his state and that of the target human are entangled, allowing for faster-than-light communication between the two. And, if information can travel faster than the speed of light, then there exist frames of reference where that information is actually traveling backward in time, so our psychic is not only being influenced by that distant target but by the *future* of that distant person. If entangled particles can act at a distance upon each other, why can't people entangle themselves with each other and so determine things about each other's states and futures?

Further, if a measurement on one particle changes the state of a far-distant particle instantaneously, then I should be able, by manipulating the parts of my mind entangled with an outside object, to exert an influence on it, and therefore affect it with only the power of thought, which leads to telekinesis, remote mind control, and various other staples of comic books that are picking up a steady following as areas of scientific pursuit.

But Don't Order Your X-Man Uniform Just Yet:

Again, this is taking an interesting phenomenon and twisting it into an unrecognizable heap of an idea. Quantum entanglement is the guardian of conserved quantities and the Uncertainty Principle. It ensures that the constraints on particles associated at one point in time are enforced when those particles become separated, no matter how vast that separation grows. But this only applies to constraints dealing with conserved quantities of the original system, like angular momentum. When two particles get entangled, they share a superpositional state between them that collapses jointly and instantaneously upon measurement into values that preserve the original quantity being measured.

This is a decidedly mathematical beast that quickly devolves into nonsense when taken from its native habitat. What precisely is the superpositional state into which two minds become locked? What is the mechanism of measurement that causes the collapse of one of the two people into a definite state? And precisely what is the thing being conserved, anyway? Pressed on these points, most parapsychologists will revert to allegory, and though the conversation grows increasingly lovely and whimsical as a result, it is also manifestly less sensible.

Entanglement is beautiful enough as it is without tarting it up with the freakish rouges of pop parapsychology. It is an effect that resoundingly preserves the strictest of quantum dictates about uncertainty by preventing us from doing two different measurements on two once-combined particles and using those measurements to learn more than we're allowed about the original system. Not only that, but it keeps some of our most basic quantities conserved in a manner that classical mechanics would not have permitted. Within the realm of these quantities and responsibilities, it can do incredible things (take a look at Walmsley's phononic diamond experiment to see a really clever application of entanglement on a macroscopic scale [http://www.nature.com/news/entangled-diamonds-vibrate-together-1.9532]). Step outside of that realm, however, and the situation immediately devolves to little more than metaphorical flailing that only makes sense if you strip entanglement of its conservative role, which is to say, if you gut it utterly of its central operating principle.

03 LIE THREE:

Heisenberg's Uncertainty Principle means that science has failed in its fundamental goal of explaining reality, and we should therefore open ourselves up to alternative reality-explaining language games, such as are offered by religion."

The Argument: Three hundred years ago, the phenomenal results of Newton's calculus-based explanation of the natural world caused people to rush too eagerly into the arms of mathematical science as the vehicle that would unveil the universe's mysteries. They overconfidently asserted that everything could be known through the tools of scientific investigation. In the 1920s, Werner Heisenberg brought that whole structure crumbling down via his Uncertainty Principle. Science, far from the flawless edifice it considered itself, is in fact filled with vast yawning gaps impenetrable by experiment, no matter how clever the experimenter, and so it has reached the limit of its explanatory powers. Therefore, it is time for other, less mathematical, perhaps more holistic or spiritual, investigatory processes to take their turn in the spotlight.

Celebration Premature:

What Heisenberg's Uncertainty Principle decidedly does *not* say is that chaos reigns in the physics kingdom. It is actually a relatively benign, but incredibly powerful, statement about what happens when two quantities don't play well together. It's worth writing it in its most general form to get a full sense of its meaning, rather than the usual position-momentum form that looks nicer but that only tells the dark side of the story:

$$\sigma_A^2 \sigma_B^2 \geq \left(\frac{1}{2i}\langle[\hat{A},\hat{B}]\rangle\right)^2$$

What this says is that if I have two quantities I want to measure, A and B, each limits the certainty of the other's measurement in a way determined by $[\hat{A}, \hat{B}]$. This is the "commutator" of $\hat{A}$and $\hat{B}$, and tells us how well these two quantities commute with each other, or in other words what the difference is between $\hat{A}\hat{B}$ and $\hat{B}\hat{A}$ (recall that, in normal mathematics, multiplication is *always* commutative—it doesn't matter what order I multiply 2 and 3 in, I'll always get 6. That's not always the case with the mathematical operations involved in quantum measurements).

What popular accounts of the Uncertainty Principle tend to leave out is that there are *plenty* of measurable quantities that work together just fine, for which $\hat{A}\hat{B}$ and $\hat{B}\hat{A}$ are exactly the same. The measurement that determines total energy, and that which determines the magnitude of angular momentum, for example, commute perfectly with each other, so $[\hat{A}, \hat{B}] = 0$, and measuring one has no impact on the other.

I can take some sensationalism in the name of grabbing the attention of students long enough to sedulously expose them to some beautiful ideas. What I can't stand is misappropriating a handful of sexy-sounding terms and then applying them metaphorically to add scientific heft to one's particular intellectual fetish.

There are, however, quantities that don't work so chummily, measurements of which get in each other's way unavoidably. *Position* and *momentum* are the classic examples, though more irresponsible mischief has been wrought from the fact that *energy* and *system change time* form another such pair. Here it's true that, if I want to take infinitely precise measurements of both members of a pair, I'll be in for nothing but frustration. Collapsing the position spike down to a fine and prominent peak will of necessity mess with my ability to measure the wavelength of the particle and therefore its momentum, and if I somehow do make a new measurement that figures out the wavelength, it will so change the particle's wave pattern that the original position measurement no longer applies.

Frustrating, yes, and to a generation of existentialists who found common ground with their own concerns in the word *uncertainty*, much was made of it. Nearly a century later, we have generally overcome that initial philosophy-brokered sky-is-falling sensationalism, and can take the inequality for what it is. It is an expression that allows us to know the upper limit on how badly two quantities will mess with each other's measurement. Sometimes the answer is "Not at all" and sometimes the answer is "A bit." Either way, quantum experimentalists needn't ready themselves to hand over the keys of the kingdom just yet. Ironically, and much to the chagrin of scientific detractors, the mathematical consequences of the Uncertainty Principle have allowed us deeper and more precise insights into the nature of reality than were ever dreamt of under the Newtonian model. It is not a sign that experimental physics has reached the limits of its efficacy—quite to the contrary, it is a century-old testament to our continually refined sense of how the observable quantities of our universe work together.

I adore quantum physics, and I welcome anybody who responsibly takes the task in hand of explaining its integral laden insights for students and the general public. It was one such book, John Gribbin's *In Search of Schrödinger's Cat*, which fell into my hands in seventh grade and set me on the road to a career as a math and science teacher. (Looking at my old copy now, there are a few things that make me cringe, but I imagine they've been corrected in the three decades since its first printing. Really, though, if you have the mathematical chops David Griffith's *Introduction to Quantum Mechanics* is the way to go.)

I can take some sensationalism in the name of grabbing the attention of students long enough to sedulously expose them to some beautiful ideas. What I can't stand is misappropriating a handful of sexy-sounding terms and then applying them metaphorically to add scientific heft to one's particular intellectual fetish. But authors (and Dalai Lamas) will continue to do so until they find themselves routinely exposed for their imprecision. I've provided the briefest sketch of some of the abuses and their worst faults, but for every one I listed there are ten left unmentioned. It is a seemingly endless battle against a lineup of feckless opportunists who never seem to diminish in number, but I figure, electrons have done a lot for us, why not return the favor? ■

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Paul Quincey, "Quantum Weirdness: An Analogy from the Time of Newton." Vol. 32.6, November/December 2008.
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Eric Scerri, "What the #$*! Do They Know?" Film review. Vol. 28.5, September/October 2004.
Robert L. Park, "Alternative Medicine and the Laws of Physics. Vol. 21.5, September/October 1997.
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Selling Pseudoscience: A Rent in the Fabric of American Medicine

A study of federal funding advancing naturopathy, acupuncture, chiropractic, and energy healing as acceptable medical protocols finds troubling misuse of taxpayer dollars.

EUGENIE V. MIELCZAREK AND BRIAN D. ENGLER

When ill, most of us choose to see a physician. If your doctor is caught practicing medicine without a license, he or she may need a criminal defense lawyer. But in 2007 about 40 percent of Americans chose unproven therapies offered by an alternative medicine practitioner, including herbs, spinal manipulation, acupuncture, and energy healing (www.cdc.gov/NCHS/data/nhsr/nhsr018.pdf). Incredibly, some Americans even reject the safety of vaccines (Offit 2011; 2013).

Currently seventeen states, the District of Columbia, Puerto Rico, and the Virgin Islands license naturopaths. All fifty states, D.C., Puerto Rico, and the Virgin Islands license chiropractors. Forty states license acupuncturists, and New Mexico, California, and Florida legally allow acupuncturists to serve as primary care providers[1]. At the national level the acupuncture lobby urged members to petition the Department of Health and Human Services to have acupuncture declared an essential medical service. Federal tax instructions for 2012 provide a line for acupuncture under medical deductions. Because the Affordable Health Care Act mandates coverage of "state licensed alternative medicine practitioners," "wellness" clinics can be set up under a state licensed practitioner who can employ energy healers and herbalists. What can we expect from their services?

In 1992, Congress, persuaded by personal anecdotes, emboldened by fiduciary interests and the Executive Office, responded to the myth that Americans were in need of alternative medicine by creating an Office of Alternative Medicine (OAM) at NIH. There was no compelling statistical evidence to support this action. From its inception, NIH's Office of Alternative Medicine and its offspring, the National Center for Complementary and Alternative Medicine (NCCAM), have funded schools of non-evidenced-based, so-called alternative medicine treatments such as naturopathy, oriental medicine, and chiropractic. The OAM archives from 1992–1999 show that chiropractic received $4 million, and naturopathic $2 million. The total funding for alternative medicine between 1993 and 2000 was $110 million (Green 2001). The yearly funding for OAM grew from $2 million in 1992 to $20 million in 1998 (NCCAM archives first meeting). Since elevation to the status of an NIH center, NCCAM's annual funding has grown to $128 million. Total funding for NCCAM from 1999–2012 was over $2 billion.

Initiatives established at the first meeting of the National Advisory Council for Complementary and Alternative Medicine (http://nccam.nih.gov/about/naccam/minutes/1999aug.htm) focused on awarding grants for training and career development for alternative medicine practitioners. A reading of these minutes details the council's presumption that even though the efficacy of non-evidenced based protocols had not been demon-

strated, funding for teaching these protocols would proceed. However, the expectation that research publications would verify or strike down the success of a protocol was never voiced. The normal expectation of federal science agencies such as the National Science Foundation is that its principal investigators will disseminate their results by publishing in peer-reviewed journals. For years, evidence has been cited showing that publication bias in favor of studies with positive results and strongly against those with negative is common in the field of medicine (Ionnidis 1998; Goldacre 2012). However, because NCCAM researchers are testing non-evidenced based protocols they should be more circumspect about posting trial results. But a posted result for a NCCAM clinical trial is rare, and substantiation or negation of a CAM protocol arising from clinical trials is seldom published (Mielczarek and Engler 2012; Ross et al. 2012). One of the characteristics of the few published results is an aversion to precise statements. To those familiar with the lack of efficacy of many non-evidenced based protocols, this may not come as a surprise. Nevertheless, NIH's NCCAM continues to funnel taxpayer funds into dubious research on these unproven—even disproven—alternative medicine protocols [2].

Our study of $2 billion in research grants to test the success of CAM yielded no positive result that would alter current evidenced-based medical practice (Mielczarek and Engler 2012). But lack of positive results did not deter continued expenditure of public money for these protocols. In 2000, NCCAM intensified the marketing of unproven therapies by embarking on a twelve-year focus to train non-evidenced based practitioners. From 2000 to 2012, over $76 million was awarded to medical schools and alternative medicine schools to initiate or enhance efforts for teaching CAM.

Our second study, "Nurturing Non-Science" (Mielczarek and Engler 2013) focused on several of these respected medical schools. We tracked the intrusion of these federally funded non-evidenced based protocols into the community clinics and hospitals they served. In addition to the usual litany of acupuncture, bioenergy, herbs, and homeopathy, some of the clinics associated with these respected medical schools featured curious concepts such as "holographic sound healing," Noetic consultants, and Tibetan energy medicine. These are only a few examples of unbelievable protocols offered by clinics associated with medical schools certified by Association of American Academic Medical schools, AAMC. Specialized medical services for children included Reiki, offered for pediatric heart transplant patients and in a children's cancer clinic, and a course teaching Reiki to children "even children can heal" (Mielczarek and Engler 2013). Reiki is one of several "hands off, hand waving" healing protocols. This concept violates the laws of physics (Mielczarek and Araujo 2011), yet is now offered in respected medical schools such as Harvard, Georgetown, and Minnesota. Major scientific societies have been remiss in failing to bring NCCAM's lack of scientific knowledge to public attention. What university would allow a Department of Engineering to market perpetual motion machines or a Department of Astronomy to employ astrologers?

The money to install non-evidenced-based curricula in fifty-three formerly respected medical schools totaled $67 million. But the funding went beyond respected medical schools. Included in the twelve-year focus was $8.6 million for curriculum and training at seven schools that graduated alternative medicine practitioners. From 1999, schools for naturopaths, acupuncturists, chiropractors, and oriental medicine practitioners have been recipients of federal funding. Figure 1 shows expenditures for both research training grants and curriculum grants for these institutions. For example Bastyr University received $827,000 for curriculum enhancement. But curriculum grants were only a small part of its NIH funding. Research and training grants bring Bastyr's total funding for

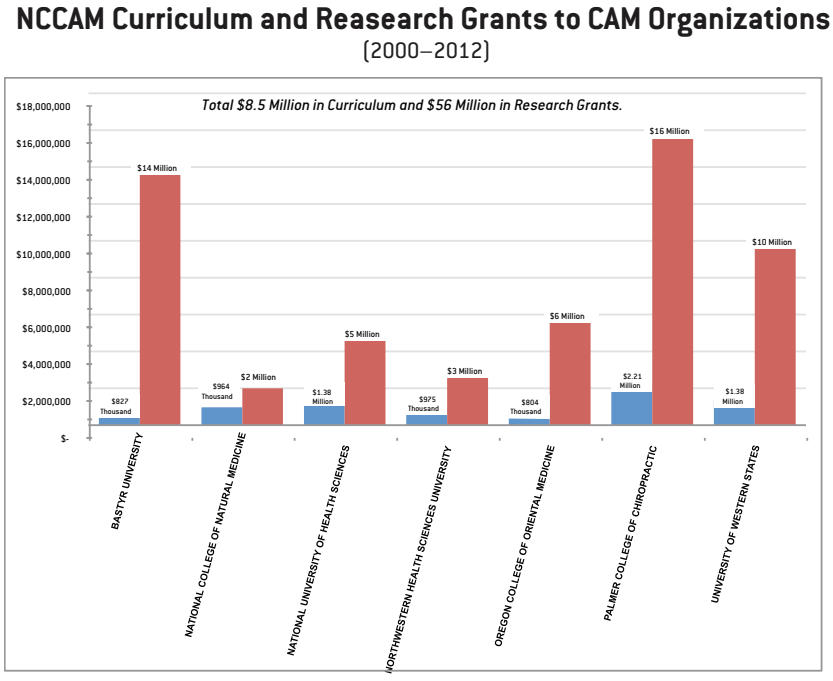

Figure 1: NCCAM curriculum and research grants to seven CAM organizations.

these twelve years to $14 million.

After twenty years, millions in NIH funding, and no evidence documenting success for protocols such as acupuncture, energy healing, or treatment by spinal manipulation, what do these alternative medicine schools and their faculty practitioners currently advertise?

This article examines how taxpayer dollars are used to advance naturopathy, chiropractic, acupuncture, energy healing, and herbal potions into American culture as acceptable medical protocols. What is their current support by NIH, our federal agency charged with maintaining health through evidenced-based research and information? We answered this question by studying the websites of these schools, NIH's Project Reporter, and the NIH database clinical trials.gov looking for publications in peer-reviewed medical journals and for results of their clinical trials funded by NCCAM monies. Alternative medicine organizations' websites advertise their support from NIH, implying that these medical misconceptions are successful medical protocols and that these programs will lead to successful careers competing with MDs. Profiles of these organizations illustrate how their advertisements for students implies federal acceptance of their curriculum, and how this conjunction helpfully markets their products.

The National University of the Health Sciences

NCCAM support 2000–2013: $3.4 million, seventeen grants, twenty-seven clinical trials, fifteen completed, no posted results.

The National University of the Health Sciences in Lombard, Illinois, with a branch in Florida, is a school of acupuncture, chiropractic, oriental medicine, and massage, with over fifty faculty members. They ". . . prepare students to become first-contact, primary care physicians who are fully qualified to diagnose, treat and manage a wide range of conditions." "From 1995-2010, National University has received $5 million in federal grant funding for research, and remains in the upper tier of complementary and alternative medical (CAM) institutions in the research field." They were "The first institution offering a chiropractic program to receive a National Institutes of Health RO1 grant, and continue(s) to be one of the highest producers of original research in chiropractic medicine." But its advice for the flu is suspect: "Since each case is different, there is no one single oriental herbal prescription or acupuncture treatment prescribed for every case of cold or flu. An oriental medicine clinician will make a careful diagnosis to determine the exact nature of the energy imbalance in each individual, and prescribe specific herbs that correspond to each patient's unique imbalance that caused them to contract a cold or flu" (http://www.nuhs.edu/news/2013/1/how-oriental-medicine-views-a-cold-or-flu/). No mention is made of immunizations with the flu vaccine. Their twenty-seven clinical trials studied a range of protocols from Echinacea for treating children with "Recurrent Otitis" to yoga as a relief for multiple sclerosis. Although no posted results have been published for any of their completed trials, four new trials funded by NCCAM are in progress.

This article examines how taxpayer dollars are used to advance naturopathy, chiropractic, acupuncture, energy healing, and herbal potions into American culture as acceptable medical protocols.

Bastyr

NCCAM support 2000–2013: $14 million, fifty-eight grants, twenty-two clinical trials, thirteen completed, three posted results; Lombard, WA, and San Diego, CA.

Bastyr's faculty advice for the flu is similar: "Being a naturopathic physician, I believe in the body's ability to heal itself. The body can do this very effectively when it is kept healthy. By taking extra good care of yourself and possibly working with a natural health practitioner, you can stay resistant to colds and the flu every winter. Remember, there are many routes to immunity besides obtaining a flu shot" (http://www.bastyrcenter.org/content/view/198/). In stark contrast, the Center for Disease Control's advice for the flu is an imperative: "All persons aged 6 months and older should be vaccinated annually" (http://www.cdc.gov/flu/protect/whoshouldvax.htm). Bastyr also offers advice for asthmatic children: "Children suffering from asthma might benefit from taking extra magnesium." But this advice is not well substantiated.

One of the more creative uses of almost a million dollars of taxpayer monies has been three years of grants to Bastyr (H35B11, 4R00AT004711-03) for a clinical trial to determine whether a sauna reduces the "human chemical burden" and promotes "general wellness, detoxification and pain reduction." There are no posted results or publications revealing the success or failure of this protocol.

Bastyr's vice president, Leanna Standish, was an original member of NCCAM's council. From 1994–2000 she was awarded $2 million (Green

2001) and from 2000 to 2013 she was awarded $9.1 million for twenty-two grants. Her NCCAM grants included a study using garlic therapy; a study that concluded that humans could transmit brain wave information to each other; and a collaboration with an Ayurvedic consortium in India: "Many alternative medical systems like Ayurveda, which are becoming popular in the U.S. have originated or are traditional in other countries. Ayurveda is an ancient, multifaceted, holistic medical system from India . . . (the) broad goal of this research is to develop collaborative relationships among researchers from the U.S. and scientists and practitioners in India to develop an international center for CAM research in India to study Ayurveda." Her clinical study on the "evaluation of Garlic in HIV disease," four awards totaling $801,000 were withdrawn.

In 2012, seven awards to Bastyr totaled $2.5 million. This money was for use of an intranasal spray for Parkinson's, using herbs for alleviation of iron overload, and an Asian mushroom *Trametes versicolor* (*PSK*) to alleviate discomfort from breast cancer surgery. The latter, a joint study with the University of Minnesota, cost $3.9 million. There were no results posted for the clinical trial testing of eleven women for possible side effects. Total NCCAM funds awarded to several universities to study this mushroom have exceeded $9 million.

Bastyr's online newsletter informs its students and prospective students how the Affordable Health Care Act can extend the role of naturopathic medicine. Bastyr's website links to the full text of this provision in the law (http://www.bastyr.edu/news/general-news/2013/01/health-care-law-creates-openings-cam-fields). Naturopathic policy-watchers rejoiced when Sen. Tom Harkin, D-Iowa, inserted into the law a section stating that insurers "shall not discriminate" against care providers acting "within the scope of that provider's license" (See http://theintegratorblog.com/site/index.php?option=com_content&task=view&id=658&Itemid=189%5C.)

The National College of Natural Medicine

NCCAM support 2005–2012: $2.4 million, fifteen grants, two clinical trials, one completed, no posted results.

The National College of Natural Medicine (www.ncnm.edu) a School of Naturopathic and Classical Chinese Medicine, is located in Portland, Oregon. Its twenty community clinics handle 17,000 patient visits a year and offer treatment by naturopaths and Chinese medicine practitioners. Its website gives specific advice for nasal conditions: "warming socks which draw the congestion from your head" and "homeopathic remedies." The college's Helfgott Institute advertises research on magnets, acupuncture, skin resistance, house plants effects on heart rate, and Ayurvedic medicine (http://www.ncnm.edu/helfgott-research/projects.php; http://www.ncnm.edu/about-ncnm/getting-to-know-ncnm/history.php). The college was funded to conduct two clinical trials. One, with sixty participants that was started in 2006, tested whether 450-gauss magnets alleviate carpel tunnel syndrome. No results were posted, but the authors concluded (Colbert et al. 2010) that "the dosages were safe" but they "were unable to inform patients whether the static magnet field was effective or ineffective." Interestingly NCCAM funded this award after the Federal Trade Commission's "Operation Cure All" forced purveyors of magnets to cease advertising. Nor were results posted for a second award comparing a "Naturopathic Anti-Inflammatory Diet" to the standard diabetic diet suggested by the American Diabetes Association.

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Awards from NCCAM from 2007–2012, to its dean, Heather Lea Zwickey (http://www.ncnm.edu/helfgott-research/research-faculty-staff.php), were $1.1 million for research and training "building a foundation for a naturopathic health services research career. In line with the mission of the AHRQ (Agency for Health Care Research) this program of research investigates naturopathic care as a means to improve the quality, safety, efficiency, and effectiveness of health care delivered in low-income and uninsured populations at the community level." Its curriculum includes courses in homeopathy, and its clinics offer homeopathic treatment. Courses of study in Chinese medicine train the naturopathic physician in the essentials of manipulating qi and the use of moxibustion at specialized qi points. A course in the "Game of Go" is designed to enhance a student's qi (http://www.ncnm.edu/images/Publications/2008-2009_NCNM_Catalog_web.pdf).

The school promotes Unda homeopathic remedies: ". . . a type of energetic medicine using diluted doses of substances to effect changes in the body and are reportedly effective for both acute ailments and for chronic, degenerative diseases" and "…homeopathic

Over the last twelve years NCCAM has funded $57 million for awards that do not recognize that a homeopathic dilution cannot provide a medical protocol.

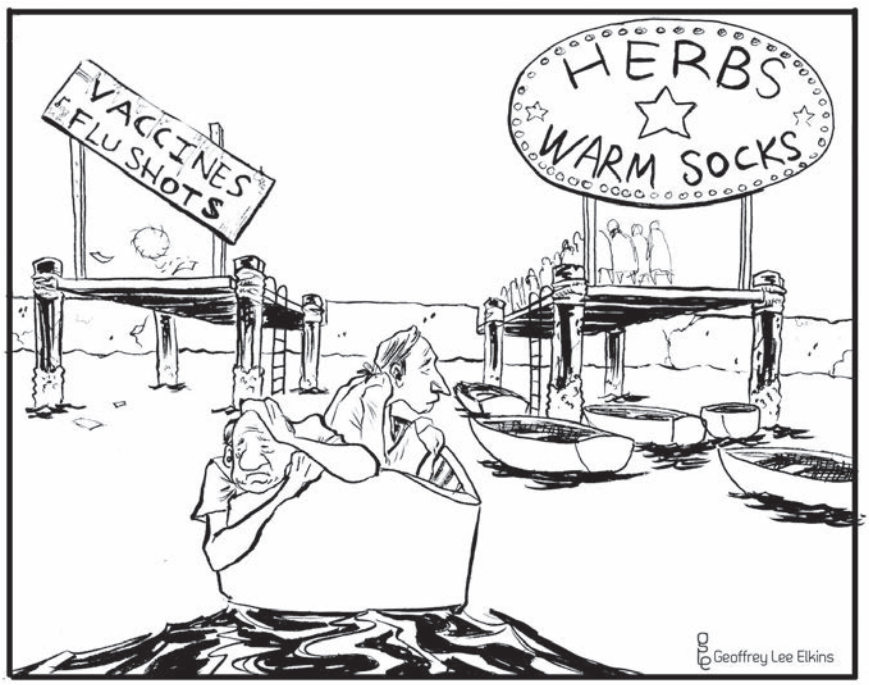
remedies that are used in Biotherapeutic Drainage," a technique that purports to help the body's own physiology eliminate toxins that are claimed to interfere with normal physiological functions. To facilitate memorizing the uses of homeopathic remedies the school recommends its homeopathic flash cards (http://quizlet.com/16683740/ncnm-homeopathy-iii-2012-part-1-flash-cards/). NCCAM's support of an institution that supports homeopathy is not a new venture. Over the last twelve years NCCAM has funded $57 million for awards that do not recognize that a homeopathic dilution cannot provide a medical protocol (http://scienceblogs.com/insolence/2012/11/19/the-success-of-nccam-grants-on-homeopathy/).

Oregon College of Oriental Medicine

NCCAM support 2001–2011: $1 million, seven awards, three clinical trials, two completed, no posted results.

Oregon College of Oriental Medicine (http://ocom.edu/), Portland, Oregon. "OCOM's academic programs provide students with a solid foundation in acupuncture, Chinese herbal medicine, therapeutic massage, and qi cultivation, as well as a focus on collaboration between Chinese medicine and Western biomedicine. OCOM's teaching clinics provide affordable care for general wellness and hands-on experience for students, as well as advanced specialty care for patients facing health challenges." In addition to acupuncture and electroacupuncture treatment, their clinics feature: herbal medicine, Japanese massage (Shiatsu), Chinese massage (Tuina), moxibustion, gua sha, (scraping the skin), and cupping. Cupping is a suction therapy that supposedly draws out pathogens and increases both qi and blood flow to an area. Movie stars with cupping scars are featured on websites advertising cupping. The Oregon College of Oriental Medicine advertises support received from NCCAM for clinical trials conducted by its faculty or in conjunction with the Oregon Health and Sciences University. The college recently completed a four-year NIH/NCCAM grant, "Acupuncture Practitioner Research Education Enhancement (APREE)" to enhance research literacy and research appreciation in academic and clinical training (http://research.ocom.edu/index.php?option=com_content&view=article&id=45&Itemid=55).

From 2001 to 2011, the seven NCCAM awards totaling $1 million for training acupuncturists included a clinical trial enrolling fifty women to determine whether Chinese acupuncture and herbs are as effective as hormone therapy for alleviating endometriosis-related pelvic pain. Clinical trials list it as completed in 2006 with no posted results. The college's funding also included a clinical trial on multiple sclerosis sponsored by NCCAM in collaboration with Oregon Health and Sciences University: "Acupuncture and herbs study for MS and other medical problems" (http://research.ocom.edu/



Line illustration prepared for this article by artist Geoffrey Lee Elkins.

index.php?option=com_content&view=article&id=49&Itemid=125). Their website advertises the college's own brand of herbal medicines, formulations for pain, cough syrups, and liniments (http://ocom.edu/index.php/Patient-Care/herbalmedicinary.html). "Feng shui" principles of healing were a basis of design for their new building opened in 2012.

Chiropractic Organizations

NCCAM's support for non-evidenced based medicine included three schools whose primary focus is chiropractic: Northwestern Health Sciences University, the University of Western States, and Palmer. From 1999–2012 NCCAM awarded these organizations $29.7 million for seventy-five grants to strengthen their curricula and training. Included were clinical trials, testing spinal manipulation velocity and manipulation for lock jaw, back pain, leg pain, and headaches. Age groups ranged from adolescents to seniors.

Northwestern Health Sciences University, Bloomington, MN

NCCAM support 2001–2012: $2.7 million, twelve grants, one clinical trial recruiting.

Northwestern advertises a recent generous joint award. "We are proud to announce the funding of another large research study that will help determine the optimal number of chiropractic treatments for neck-related headaches. Northwestern Health Sciences University, in collaboration with the University of Western States, was awarded $3.3 million from the National Institutes of Health, National Center for Complementary and Alternative Medicine. The funding of this study is truly remarkable in these tough economic times. We are very proud of the study's lead scientists Dr. Gert Bronfort, Northwestern's vice president of research, and Mitchell Haas, Western States, whose perseverance and commitment to quality are a true testament to leadership and research excellence." The study's purpose is "determining the number of visits to a chiropractor for spinal manipulation and light massage necessary for the optimal relief of cervogenic headache" (that is, headache with associated neck pain) (www.nwhealth.edu/research/news/headache-grant/). However, recent published results of Gert Bronfort's previous NCCAM-funded study of 272 subjects concluded that in the long term, home exercise with advice was as effective as spinal manipulation (Bronfort et al. 2012). It's not clear why NIH has committed $3 million to restudy this non-evidenced based protocol. Northwestern staffs several clinics with a wide range of specialties. Its chiropractic clinic advertises that they treat any sports related injury and children with colic and middle ear infections (www.nwhealth.edu/bloomington-natural-care-center/clinical-services/chiropractic/). Another clinic sells their product line of medicinal teas, tinctures, and essential oils (www.nwhealth.edu/woodwinds/supplements-and-products/).

University of Western States Chiropractic College

NCCAM support 2005–2012: $6 million, sixteen grants, twenty-two clinical trials, one posted result.

University of Western states, in Portland, Oregon (http://www.uws.edu), mentions NIH's NCCAM as a research partner (https://www.uws.edu/evidence-informed-practice-resources/). Six clinics offer chiropractic services, massage, and acupuncture.

Palmer College of Chiropractic

NCCAM support 1999–2012: $16.8 million, forty-four grants, three clinical trials, no posted results.

Palmer is located in Davenport, Iowa; San Jose, California; and Florida. Funds from NIH NCCAM include an award for a $3.5 million center. (U19 AT00466301----06) (http://www.palmer.edu/Research/GrantsandProjects/).

Medical advice from chiropractic organizations can be confusing, creating medical misconceptions. "Make sure you educate your patients every chance you get. An example of this is

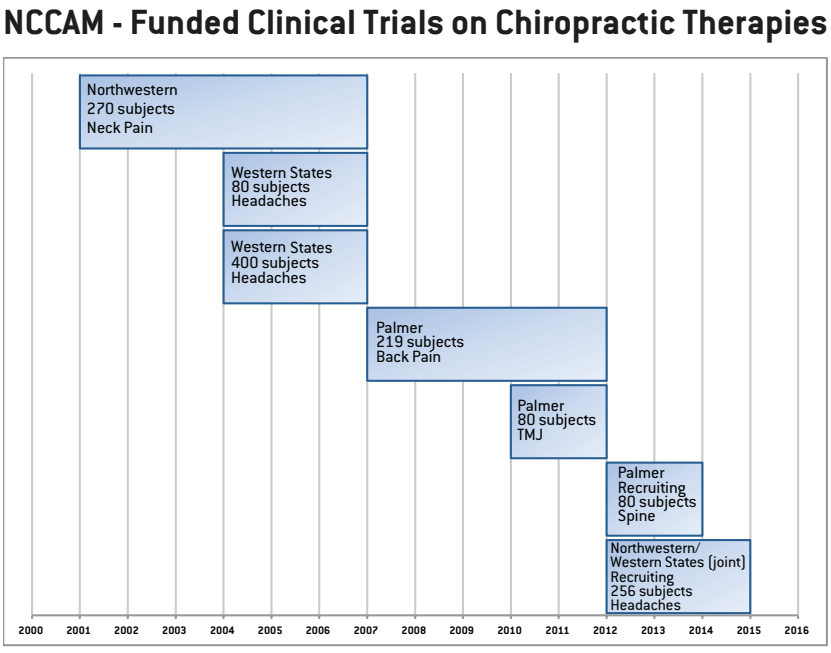


Figure 2: NCCAM-funded clinical trials testing chiropractic therapies.

NCCAM-Funded Clinical Trials Testing Chiropractic Therapies

Trial	Dates of Trial	Clinical Trial ID	Grant ID
Northwestern Health Sciences 270 patients	2001–2007	NCT00029770	R01AT0007070105
University of Western States 80 patients	2004–2007	NCT00246350	R21 AT002324, R21AT002324
University of Western States 400 patients	2004–2007	NCT00376350	U01 AT001908, U01AT001908
Palmer 219 patients	2007–2012	NCT00830596	U19AT004137
Palmer 80 patients	2010–2012	NCT01021306	DCRC1-P2, 5U19AT004663-02
Palmer 80 patients	2012–2014	NCT01670292	PRiSM Study, U19AT004663
Northwestern Health and Western States 256 patients	2012–2015	NCT01530321	R01AT006330

The expenditure of $8.6 million supporting schools educating practitioners of non-evidenced based protocols competing with physicians is an unwarranted use of America's scarce medical resources.

letting parents know that 'chiropractors don't treat ear infections; we take care of subluxations that may help with ear infections. By adjusting the spine, we do several things that may help ear infections, such as help with lymphatic drainage and allow the Eustachian tube to drain properly...It's helpful to use analogies, such as comparing an ear infection to a blocked sink'"(http://www.palmer.edu/Palmer/Pages/NewsItem.aspx?id=865). And from Western States: "... many patients use chiropractic care for the successful treatment of their non-musculoskeletal conditions such as allergies, high blood pressure, digestive disorders and otitis media" (http://www.healthcentersofuws.com/chiropractic-services/). However, the American Academy of Pediatrics in its report on parental use of CAM for otitis states, although "most (CAM) treatments are harmless, some are not. Some treatments can have a direct and dangerous effect, whereas others may interfere with the effects of conventional treatments. Clinicians should become more informed about CAM, ask whether they are being used. To date there are no studies that conclusively show a beneficial effect of alternative therapies used for Acute Otitis Media" (http://pediatrics.aappublications.org/content/113/5/1451.full).

Figure 2 tracks the progress of seven clinical trials funded by NCCAM testing spinal manipulation as a protocol. The sidebar specifies the awards associated with these trials. A taxpayer suffering from headaches or low back pain who is considering chiropractic manipulation for relief from their pain might search clinicaltrials.gov for information regarding the success or failure of a manipulation protocol. However, upon viewing the lack of posted results for completed trials involving hundreds of subjects, reasonable people would probably reject manipulation as a medical choice. They might also question the uninterrupted expenditure of government monies initiating each set of new trials. By searching Project Reporter they would learn that for the last thirteen years at a cost of $29.7 million NCCAM has sponsored grants for spinal manipulation in creatures from cats to people, compared manipulation with yoga, sham procedures, mechanical versus manual, covering fourteen states and Canada, in hospitals and medical schools, with no conclusions about the usefulness of this endeavor. Funded were one hundred projects that included nine clinical trials.

The expenditure of $8.6 million supporting schools educating practitioners of non-evidenced based protocols competing with physicians is an unwarranted use of America's scarce medical resources. Taxpayer dollars are being directed to a social comfort marketed by a billion-dollar industry. Because websites of these institutions list NIH's support of their non-evidenced protocols they are effectively marketing acupuncture, naturopathy, chiropractic, and oriental herbal practices as reasonable choices for medical care.

Congress refuses to recognize that endorsing these non-evidenced-based protocols supports a commercial enter-

prise that has no documented history of solving medical problems. These institutions sell their patients non-evidenced-based protocols even when they violate the laws of physics and chemistry. This is not the path to health care. Is there a congressman who, injured in a car accident or suffering a heart attack, rejects EMTs from the local hospital and insists on calling a licensed alternative medicine practitioner? Would a congressman exposed to hepatitis or SARS virus choose a state licensed naturopathic or oriental medicine practitioner rather than an MD? Surely no members of Congress caring for his or her family would be persuaded by advice that ". . . naturopathic physicians and acupuncturists can meet the health care needs of your entire family . . ." (http://bastyrcenter.org/content/section/4/95/).

This inconceivable focus on non-science-based medicine betrays the administration's intent to bring medical care to the poor and less educated.

A prime example of the failure of alternative medicine in recent history is the well-documented explosion of AIDS in South Africa. Exacerbated by the medical instructions of its prime minister, Thabo Mbeke, South Africa's government promoted a naturopathic solution to AIDS: a diet that included lemons, garlic, and beet root. Naturopathy, acupuncture, herbs, spinal manipulation, and ethnic medicine provide a mythical comfort but cannot address bacterial or viral infections or diagnose heart disease or cancer. Health problems at the global level are emerging diseases from animal populations (zoonosis), coronavirus (SARS), drug-resistant tuberculosis, and mosquito-transmitted West Nile fever. Does anyone believe these will be solved by herbal potions, spinal manipulation, or warm socks? Improving health in all parts of the globe will come not from wishful thinking but as a result of scientific research.

For centuries, humans traveled to the tops of volcanoes, returned with holy water from Lourdes, bathed in the Ganges on specified days, or climbed the steps of a shrine on their knees. The extent of present-day alternative medicine may not be so colorful but now it is supported by our taxes.

This inconceivable focus on non-science-based medicine betrays the administration's intent to bring medical care to the poor and less educated. Most Americans do not realize how deeply the Federal government is an enabler of this $34 billion dollar industry. Belief in non-evidenced based protocols, some of which are popular in other cultures, provides a social comfort that NIH has confused with medical progress. ■

Notes

1. The posts of Jann Bellamy, JD, published on www.sciencebasedmedicine.org provide the most complete and current information on state licensing of alternative medicine practitioners.

2. The studies of Edzard Ernst and collaborators such as "*Complementary Medicine. The Evidence So Far.* A documentation of our clinically relevant research. 1993–2010 (last updated January 2011)" are downloadable from (www.quackwatch.org/08Misc/ernst_cam.pdf).

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UFOs and Cognitive Science: A Case Study

Two psychological principles create UFOs and their alien pilots: Interpretation of what we have seen and cognitive dissonance in our investment in those interpretations.

MATTHEW J. SHARPS

Cable television is currently infested with a surfeit of programs concerning UFOs and aliens. Virtually all of these programs feature attractive UFO "professionals," though how you become a professional in that field is never adequately explained. These individuals spend an inordinate amount of airtime interviewing people who claim to have seen UFOs (or the aliens who presumably pilot them).

Many accounts of UFO experiences are fairly obvious fakes, reported in the ongoing pursuit of fame and fortune on the part of the "witnesses." Other accounts, however, present a problem. Many of the people who report these things appear to be sincere and in some cases to have been quite traumatized by whatever they saw.

Why do responsible persons report these things? They are often ridiculed for their reports, and they shouldn't be. Ridicule should be reserved for the fakes, and for the television shows that support this nonsense. But sincere, honest people continue to insist that their accounts are correct.

Why? What exactly is going on?

The Nature of Vision

Vision is a funny thing. It operates both at the level of detection *and interpretation*. Often, we see what we anticipate, and we fail to see what we don't expect.

In my primary research, the experimental investigation of cognitive factors related to forensic issues, I have often seen people fail to report mock improvised explosive devices (IEDs) they are looking at. They don't expect IEDs in those particular contexts, and though their eyes encounter the bombs their brains fail to register them (Sharps et al. 2010a).

In the realm of eyewitness memory, we have also found that the second most common type of errors (after mistakes in the appearance of a crime suspect) are *errors of the imagination*, in which witnesses create, in their own minds, stories about field-valid crime scenes that have no basis in anything at all other than their own minds (Sharps et al. 2009; Sharps 2010).

These forensic findings apply directly to the realm of UFOs. Paranormal "sightings," including those of UFOs, are rarely, if ever, created out of thin air. Many common objects provide ample opportunities for misinterpretation, if you're in the right frame of mind. For example, sea-monster cryptids such as the Loch Ness monster are never perceived in isolation. For one thing, water is necessarily involved; but for another, floating logs, schools of salmon, and all sorts of waves with things in them may look fairly reptilian with the right mindset.

If you don't expect IEDs, you frequently don't perceive them at all, even when you're looking right at them. If you expect wet dinosaurs, it would be perfectly possible to interpret a bunch of fish as a plesiosaur. The same principle could readily be applied to the myriad odd lights one might see in the night sky, just as this principle applies to a variety of situations in the varied world of eyewitness memory in criminal investigation (e.g., Sharps 2010).

Psychological Realities

But how are scientifically explicable phenomena converted, in the minds of witnesses, into nonexistent entities such as starships and their alien pilots? In previous research, my students and I have shown that beliefs in aliens and in their supernatural cronies (such entities as Bigfoot, ghosts, and the Loch Ness monster), have their origins in purely psychological factors. Those normal people who tend toward beliefs in unknown creatures tend toward subclinical, nonpathological symptoms of attention deficit. Those who believe in ghosts tend toward subclinical, nonpathological depression. Those who tend to believe in pretty much *everything* tend toward subclinical dissociation (SCD, emphatically *not* the clinical condition termed dissociative disorder; see Sharps et al. 2006).

Nonpathological dissociative tendencies may produce conditions under which everyday stimuli may take on supernormal properties. Individuals with SCD tendencies may believe in *anything*, be it ghosts, UFOs, Bigfoot, or the 2012 Mayan apocalypse that didn't happen. These tendencies may further incline them toward the *perception* of pictures purported to be those of Bigfoot and aliens as the real things, rather than as hoaxes or as unclear, ambiguous photographs of everyday items (Sharps et al., 2010b). Some of this research was reviewed and reported in recent articles in the Skeptical Inquirer (Sharps 2012; Sharps et al. 2013).

These findings can be applied directly to the realm of UFOs. Here, I would like to present my own, personal observation of perfectly normal things in the sky that could readily, in the right frame of mind, be transformed into alien objects. As an unregenerate skeptic, I understand exactly what it is that I saw, and the scientific principles that underlay that perception. However, what if I had a different frame of mind, that of a true believer in extraterrestrial visitors?

Observations and Their Potential Interpretation

I was out on my patio after dark. To the west, there was a large, brilliantly glowing disc-shaped or spherical light.

However, when I sat down in a chair, *the brilliant sphere changed*.

The bright globe of light became indented, in a C-shape like a crescent moon, but with encircling horns. For all the world, it looked like a spherical spacecraft, perhaps something like a *Star Wars* Death Star, which had opened its hangar doors to admit exploratory shuttlecraft.

And to the right of the object, *two small glowing objects* (the shuttlecraft?) were clearly visible. As I watched, one of them approached the larger object *and then disappeared*. (Did it enter the Death Star's force field for admission to its hangar?)

The other small object, in clear negation of current laws of aerodynamics, *went straight up*.

Now, as we all know from endless repetitions on the UFO shows, we Earthlings have no aircraft that can do this. Nothing terrestrial *goes straight up*. Granted, for some reason, they always leave rockets out of these discussions, but I live in the mountains above Fresno, California, a devoutly agricultural area. There are no rockets here. But nevertheless, from my vantage point, the light appeared to travel *straight up*.

As an unregenerate skeptic, I understand exactly what it is that I saw, and the scientific principles that underlay that perception. However, what if I had a different frame of mind, that of a true believer in extraterrestrial visitors?

Now, as is usually the case, my "UFO encounter" took place in isolation, visible to me alone. But suppose I had been in the company of someone who truly believes in aliens and UFOs. *What would he have thought he'd seen*?

Clearly, from his hypothetical perspective, this was a spherical mother ship, the shape frequently alleged to be very likely to be used in interstellar or intergalactic adventures. It opened

its force fields and its hangar deck (so familiar from science fiction television shows and films) to admit an exploratory shuttle craft, while another such craft flew straight up to pursue its nefarious purposes.

What Did I Actually See?

The disc, or globe, was the planet Venus. It was low in the night sky, so Earth's atmosphere, acting as a lens, magnified the planet's image slightly to my gaze. Additionally, because Fresno is frequently shrouded in a fog of agricultural pollution, the object's outline was further dimmed and thereby enhanced in its size and spherical shape.

Why did it change to the C-shape? Well, if you ever took college physics, or even ninth-grade physical science, you experimented with diffraction grids. Do you remember rotating two of those grids between the screen and the light source? The light changed shape, from its original round configuration to a variety of others. Including the fat, horned C-shape that I saw.

On my property, there are two trees on a descending slope, in direct line of vision between my chair and the planet Venus on that night. I couldn't see the trees, of course; it was dark. But their branches and leaves provided a splendid diffraction grid. (The trees were clearly responsible; when I stood up, Venus returned to its original round shape. When I sat back down, it returned to the C-shape of a starship engaged in imaginative shuttlecraft docking.) As to the shuttlecraft, well, there *was* something a little unusual going on. My point of view was in line with the Fresno airport. Two small aircraft were in fact too close together.

When this happens, air traffic controllers tend to order the planes into a flight pattern in which they would avoid crashing into each other. In this case, the controllers ordered one aircraft to change course drastically, and they ordered the other to a higher altitude.

Now, the airplane that had to change course flew directly away from me, into the pollution shroud of Fresno. Of course it disappeared, in the same way that a boat sailing into the fog would disappear. The aircraft did not engage a "cloaking device"; it simply flew away from me, on a direct line. So I perceived its "disappearance" as it vanished into the pollution haze.

So, where one person sees two airplanes and the planet Venus, another would potentially see a sci-fi invasion. One need not invoke the terrible specter of mental illness to understand this. One need simply invoke differences in ideas, *in the sources of interpretation*.

What about the other one? Well, an aircraft climbing can be seen as ascending along the hypotenuse of a right triangle. But, suppose the observer is situated directly in the plane of that right triangle, as I was. There will be no way for that observer to see the aircraft's motion along the hypotenuse, or indeed along its horizontal axis. All that the observer will perceive is the *vertical* component of its motion. Thus, to that observer (me) the aircraft will be perceived to be flying *straight up*.

I don't *know* that this is the source of all those vertically flying aliens on the UFO programs; but I suspect strongly that it is.

Detection versus Interpretation

So we have two conflicting accounts of the same visual phenomenon. Both observers, a hypothetical true believer in the UFO menace and me, would have *detected* exactly the same thing; but our *interpretation* would have varied drastically, and as follows:

True Believer: The mother ship opened her shields to admit one shuttlecraft. The other flew *straight up* in violation of current Earthling aerodynamics.

Me: The planet Venus was magnified by the atmosphere. The round image was rendered vague by the pollution. When I sat down and changed position, branches and leaves, on the dark-shrouded trees in my new line of sight, diffracted the light into a rough C-shape. Two small airplanes landing at the Fresno airport were ordered by the control tower to move away from each other.

Detection versus interpretation. Both I and my hypothetical true believer would have seen, *detected*, exactly the same thing. But our *interpretations* would have varied drastically.

Personal Investment

So, where one person sees two airplanes and the planet Venus, another would potentially see a sci-fi invasion. One need not invoke the terrible specter of mental illness to understand this. One need simply invoke differences in ideas, *in the sources of interpretation*. Therefore, we can see, in terms of normal human psychology, how UFO manifestations might be perceived.

But why do so many sincere, honest people cling so strongly, even in the face of ridicule, to their beliefs that they have seen "something from beyond"?

Cognitive dissonance is a venerable psychological principle intensively investigated by the psychologist Leon Festinger (1957). It can be summed up, basically, in the following simple principle: the more you pay, the better you like. In other words, if you make a substantial investment (monetary, physical, or emotional), in a given idea

or perspective, you are far more likely to hold to that perspective, against all opposition, than if you make a small investment or none at all.

To illustrate this, consider the following (extremely) hypothetical case. Suppose I go to an art sale at a farmer's market. There I purchase two original Rembrandts. For one, I pay ten million dollars. For the other, I pay $26.95 plus tax. I then show them to an art history professor. She tells me that they were both painted by *Sam* Rembrandt, who lives up the street. In other words, they're fakes. Do I believe her?

Well, concerning the insanely cheap Rembrandt, why not? It's a nice painting; I like it; it was cheap; so I hang it in my garage workshop for occasional aesthetic enjoyment.

But how about the other one?

Are you kidding? *I paid ten million dollars for this thing*. Of *course* it's a genuine Rembrandt. Cognitive dissonance sets in. I create, *from my imagination*, elaborate reasons why this is a genuine Rembrandt, and for me, it always will be.

If you doubt that this ever happens, even in the relatively staid world of art criticism, spend a little time looking at the history of art in some of the great museums of Europe. Once a fake is pronounced genuine by enough art experts in a given museum, it tends to *remain* genuine, for all intents and purposes (e.g., Gladwell 2005).

Cognitive Dissonance and UFOs

How does this apply to UFOs? Well, suppose a true believer sees what I saw from my patio. He decides that he's seen genuine spacecraft. His boss disagrees, jocularly and condescendingly. So do his coworkers. His spouse says the same thing, repeatedly and vociferously, and starts talking to divorce lawyers.

But, cognitive dissonance sets in. He *knows* what he saw, because he didn't take cognitive psychology in college and he doesn't know the difference between detection and interpretation. He has a *huge* emotional investment in his UFO observation. So, he buys a minivan and a number of extremely expensive cameras. He has "United States UFO Project" painted on the side of the van, and he heads out for Area 51.

He has just destroyed his life, because of the planet Venus and two slightly confused private pilots; and for what it's worth, I have seen similar things happen in real-world cases.

The 'Reality' of the Paranormal

The radical environmental author Edward Abbey (1989, 11) once asked the question "Is a mirage real?" Then he answered himself: "Well, it's a real mirage."

This obvious joke has some very real consequences for the paranormal generally and for UFOs specifically: *Are they real*?

Well, UFOs, aliens, and all the rest are, in a sense, *real*. They do exist, in the imagination but not in physical reality. They inhabit the lowest level of Plato's divided line, together with other mental images and the interpretation of shadows. UFOs exist, but they exist in the infinitely inventive interstitial spaces of the mind, not in physical reality. Thanks to cognitive interpretation and to cognitive dissonance, UFOs create a pseudo-reality that at best confuses the efforts of serious science and at worst damages or destroys the lives of intelligent, inquiring human beings. These people may be human beings who might have become first-rate scientists, if they applied the principles of cognitive science to the infinitely varied physical stimuli that are daily presented to our eyes and to our minds.

It is to the *interpretation* of UFOs, not their putative physical reality, that we should direct our attention. Two psychological principles create UFOs and their alien pilots: interpretation of what we have seen and cognitive dissonance in our investment in those interpretations. It is pity, rather than censure, we should direct toward those who endure unemployment, and divorce, and the purchase of embossed minivans, in the service of their nonphysical alien overlords. UFOs exist but not in reality; they take their form in the creative and imaginative spaces of the human mind. It is to that interior world, rather than to a hypothetical physical world of the human imagination, that we should direct our attention. ■

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Connecticut's Hidden Animals?

KENNETH L. FEDER

I was driving down Farmington Avenue, a very busy thoroughfare in West Hartford, Connecticut, at a little before seven in the morning (far too early to be up and about) when I spotted an animal crossing the road from my right at a distance of about 200 feet. It seemed to be about as big as a medium-sized dog, but it clearly wasn't a canine. It was tawny in color, its back was curved, and it loped across the avenue in a strange hopping motion, as if its rear legs were substantially longer than its forelegs. My initial, nearly instant identification of the animal moving so peculiarly across the road made no sense at all in the upscale Connecticut suburb through which I was driving: it was a capybara. That was crazy. Capybaras are extremely large rodents, in fact, the largest on our planet, and they are native to South America, not Connecticut. I have never encountered a capybara in the wild, but I have seen them in zoos, and the animal I briefly glimpsed crossing Farmington Avenue in April 2013 appeared, at least initially, from a great distance and under poor lighting conditions, to be one, at least a small one.

The rational part of my mind recognized almost immediately thereafter that the identification I had come up with was nonsensical. But was it? After all, there is a museum in West Hartford with a small menagerie of wild animals. I know they have a bobcat, lynx, hedgehog, and a number of other critters on display there. Maybe they have a capybara, and it had escaped. Could be. Another possibility was an exotic pet. Yup; do an Internet search for "capybara pet," and you'll find numerous webpages in which people extol the virtues of sharing their homes and lives with what amounts to gigantic, überrats that may weigh in at more than 100 pounds. Maybe, the thought flashed through my mind, a local resident kept a capybara as a companion animal and the poor thing had gotten loose.

The rational part of my mind recognized almost immediately thereafter that the identification I had come up with was nonsensical. But was it?

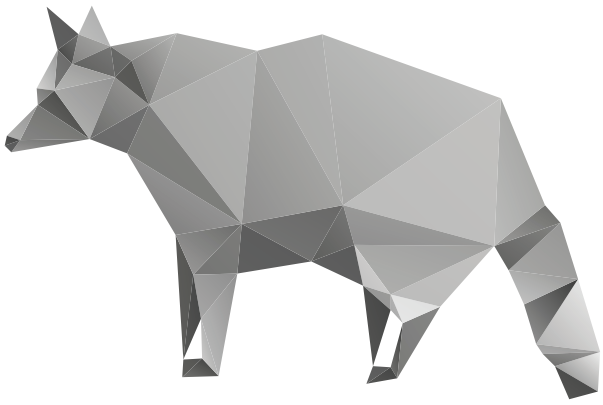
Determined to figure out what the animal actually was, I watched as it reached the other side of the road where it initially disappeared into a culvert diverting a stream into a grassy dell. Just past where the animal had entered the little stream valley was a driveway leading to the parking lot of the local Whole Foods, and I turned into it, hopeful but not particularly optimistic that I would see the animal again for a better look and the opportunity to assess my original, seemingly impossible diagnosis of—what? A wayfaring giant South American rodent that had managed to migrate thousands of miles, across numerous national borders, only to end up in Connecticut, a furry alien on its way to shop at the nearby Whole Foods for some free-trade, organic capybara kibble? It seemed ridiculous in the extreme, but at least based on my initial observation, that's exactly what I thought I had seen.

Looking to my left as I drove into the Whole Foods parking lot, amazingly, I saw the creature again, was able to view it at a much closer distance, and recognized it for exactly what it was. No, it was not a capybara, nor was it one of its much smaller relatives, the agouti, another South American native. Embarrassingly, it was a representative of a species I was very familiar with for all the grief its kind has given me by breaking into my trash cans. The animal I had initially identified as a giant South American rodent was, in actuality, nothing more than a large raccoon that was moving in a peculiar way because it was missing its right rear leg.

The tale of a resilient raccoon who had managed to survive a traumatic injury to one of its legs and its ability to adapt to its condition so well is remarkable enough. But that's not the purpose of my sharing this experience with you.

My story is a cautionary tale you might consider when you read or hear all of those eyewitness accounts of Bigfoot, the Loch Ness Monster, the chupacabra, and on and on.

The etiology of my misidentification seems clear enough. Barely awake, I spot an animal that, based on its appearance and movement, doesn't immediately match anything I'd expect to see crossing in front of me on Farmington Avenue. In a virtual instant, my brain leapt into action, searching my neural database for a word, an identification, a diagnosis for the strange and unexpected critter I had just seen. The closest match I could come up with based on what I had briefly observed without preparation was an animal that has no business being in West Hartford. But it's the best I could do in that instant when my mind was demanding an explanation and attempting to find one based on incomplete and not terribly reliable data.



My initial identification is a reflection of how our brains work. We encounter something out of the ordinary—maybe it's a strange light in the sky, an unexpected noise in an old house, or an oddly moving animal—and our minds demand an explanation. Even under poor conditions for observation—lighting is weak, the distance is great, we're tired, we're not wearing our glasses—we make instant deductions and leap to conclusions, regardless of the sensibility of those deductions and conclusions.

I suppose it's adaptive, born of our evolutionary history as bipedal hunters on the plains of Africa. Indeed, it is better to be safe than sorry, and the survival of our ancestors depended on being careful in the face of incomplete information. Better to interpret the subtle movement in the grass in front of you as a lion intent on making you her meal, better to think you actually see that lion and respond accordingly, than to be skeptical of or even ignore the possible danger. If you're wrong, all that results is a brief scare: your heart races, and then relief. If you're right about the lion, however, you just might save your life.

Given the chance, and if we're curious enough, we accept that our initial deductions and conclusions concerning our observations are merely first guesses and we investigate further. That's why I followed up on my initial identification and followed the animal as it ran down the side of the streambed where I saw, not a capybara, but a three-legged raccoon doing its thing. Now imagine if I hadn't gotten a closer, lengthier look at the animal. I might still be telling the story of the feral, peripatetic capybara of West Hartford, Connecticut. Maybe I'd put up a website, collecting other eyewitness accounts of the capybaras of Connecticut, and I'd generate thousands of hits and elicit the reports of, maybe, dozens of kindred spirits who are also certain of the existence of packs of giant South American rodents haunting the forests, hills, and even the cities of southern New England. Don't think that would happen? Type in the term "Alien Big Cats" in whatever Internet search engine you use and you'll find hundreds of references to people in Great Britain who claim to have seen large, clearly non-native, wild felines prowling the British countryside. But it is almost certainly the case that there are about as many leopards wandering the moors of Cornwall as there are capybaras crossing West Hartford, Connecticut's Farmington Avenue.

It's not that people are stupid (notice how self-serving that statement is since I'm the guy who thought he saw the capybara) or that everybody who sees a Sasquatch, living dinosaur, flying saucer, or ghost is lying. It's a reflection of the demand placed on our brains and honed by millions of years of evolution, to diagnose and identify what we observe to quickly determine if what we have just seen is friend or foe, something to eat, or something that will eat us. As behavioral scientists we recognize this process. But, apparently, we are not immune to it. ■

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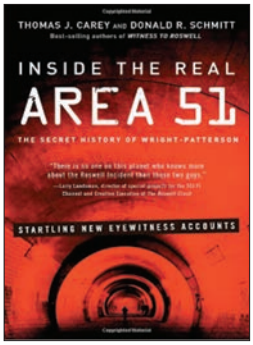
Saucer, Saucer, Who's Got the Saucer?

ROBERT SHEAFFER

Visualize three big cups, and one little flying saucer. The saucer is put under one cup, and the cups are shifted around. Keep your eye on the cup with the saucer! Suddenly they stop: Which cup contains the saucer?

1. **Area 51 in Nevada**
2. **The Pentagon** (or another federal facility around the District of Columbia)
3. **Wright-Patterson Air Force Base in Ohio**

And the answer is: all three (if certain witnesses are to be believed), although *Inside the Real Area 51: The Secret History of Wright Patterson* is a book about the last one, Wright-Patterson AFB, where the famous Hangar 18 supposedly contains alien bodies. The authors correctly trace the origin of the Hangar 18 story to yarns told during the 1970s by Professor Robert S. Carr, who it turns out was never "professor" of anything, never even went to college, and who made up all manner of wild tales. They even quote from an interview where Timothy S. Carr, his son, said that his father just made up the story about crashed UFOs, adding, "I am so very sorry that my father's pathological prevarication turned out to be the foundation on which such a monstrous mountain of falsehoods has been heaped." (The authors failed to provide any reference for that interview: it's from the Skeptical Inquirer, July/August 1997.)


THOMAS J. CAREY AND DONALD R. SCHMITT
INSIDE THE REAL
AREA 51
THE SECRET HISTORY OF WRIGHT-PATTERSON
STARTLING NEW EYEWITNESS ACCOUNTS

***Inside the Real Area 51: The Secret History of Wright-Patterson*. By Thomas J. Carey and Donald R. Schmitt.** New Page Books, Compton Plains, New Jersey, 2013. ISBN: 1601632363. 288 pp. Paperback, $16.99.

But the authors accept Robert Carr's story anyway, because other witnesses, mostly secondhand, supposedly confirm it. Somebody's father or grandfather insisted it was true. It turns out that there is no Hangar 18 at Wright-Patterson. Not a problem: there *is* a *Building* 18, and we are told in a photo caption that Hangar 23 is "connected to Building 18's underground levels, it was where the Roswell wreckage was first deposited prior to permanent storage in Building 18."

Ben Hansen was the host of *Fact or Faked?* on the SyFy Channel. He relates that his grandfather, Merlin Hansen, did some work on "underground hangar elevator systems" at Wright-Patterson, including "Building 18." On his deathbed, Grandpa Hansen, a man of absolutely unquestionable veracity, confided to his son Poppa Hansen, "Son, we are not alone." From ironclad accounts such as these, the authors conclude, "We are persuaded that most of the Roswell crash wreckage as well as at least four alien cadavers from that crash were initially delivered to Hangar 23 at Wright-Patterson AFB."

For proof of nefarious secret Air Force UFO projects, the authors waste several pages showing documents proving that the late J. Allen Hynek, former scientific consultant to the Air Force's Project Blue Book, contracted to do consulting work with the Air Force during his summer break at Northwestern, even after Blue Book was closed. His area of expertise was said to be "orbital bodies and atmospheric phenomena," and the term of the contract was only a few days each year. The summer consulting gig is a common practice of academics everywhere, but the authors are squeezing every drop of "mystery" out of this that they can.

Throughout the book, we are treated to many dubious claims. "A USAF flight surgeon, [Colonel D'Jack] Klinger, was once given the duty of lo-

cating and retrieving a disabled bomber on the U.S./Canadian border armed with nuclear weapons." Had such an event actually occurred, we certainty would have heard a great deal about it. We also read alien autopsy notes from an unnamed physician, and the testimony of an anonymous nurse that, on his deathbed, Air Force General George R. Weinbrenner told her, "We have five aliens in Utah."

In the book's foreword, Hollywood writer/director/producer Tracy Torme (who has been involved in UFOlogy at least since the 1980s) emphasizes the authors' "impeccable reputations and personal integrity." Surely he has not forgotten the 1995 scandal where "Schmitt claimed he had a bachelor's degree, a master's degree and was in the midst of pursuing a doctorate in criminology. He also claimed to be a medical illustrator. When checked, it was revealed he was in fact a letter carrier in Hartford, Wisconsin, and had no known academic credentials." This caused his former Roswell partner, Kevin Randle, to write, "The search for the [Roswell] nurses proves that he [Schmitt] will lie about anything. He will lie to anyone. . . . He has revealed himself as a pathological liar . . . I will have nothing more to do with him" (http://en.wikipedia.org/wiki/Roswell_UFO_incident).

If you want to see how to create a UFOlogical legend from gossamer, this book shows how it can be done.

Recently, Randle complained about this book in a letter to another UFO researcher (published in a blog but since removed), "[Schmitt] had told me that it was about Wright Field and Wright Patterson Air Force Base . . . I had no idea that he was going to delve as deeply in the Roswell pool as he did." The two have reconciled somewhat recently, owing to the need to work together on something called the "Roswell Dream Team": the (supposedly) very best investigators cooperating to deliver "smoking gun" proof of the alleged Roswell Saucer Crash. But with the rapid passing of those old enough to remember the events of 1947, any new "bombshell witness accounts" will necessarily be secondhand, at best.

If you want to see how to create a UFOlogical legend from gossamer, this book shows how it can be done. It might be entertaining, but it contains little if anything that is credible. ■

Robert Sheaffer is SI's "Psychic Vibrations" columnist and author of *UFO Sightings: The Evidence*. He blogs at www.BadUFOs.com.

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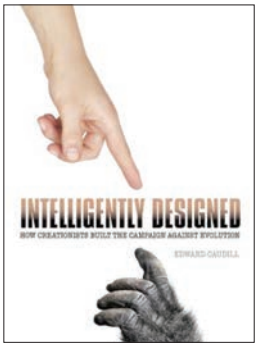
Myths and Media in the Creationist Movement

GLENN BRANCH



***Intelligently Designed: How Creationists Built the Campaign against Evolution*. By Edward Caudill.** University of Illinois Press, Urbana, Chicago, and Springfield. 2013. ISBN 978-025-07952-8. 216 pp. Softcover, $25.00.

Why a new book reviewing the history of the creationist movement in the United States? Edward Caudill contends that his book *Intelligently Designed: How Creationists Built the Campaign against Evolution* distinctively emphasizes "the use of enduring cultural myths and the dexterous employment of mass media" (6) in explaining the success of the creationist movement, and he further proposes that the Scopes trial of 1925 established a template for the ensuing developments. Caudill's publication record, which includes *Darwinism in the Press: The Evolution of an Idea* (1989), *Darwinian Myths: The Legends and Misuses of a Theory* (1997), and *The Scopes Trial: A Photographic History* (2000), certainly suggests that he is equipped for the task. But his latest book is something of a disappointment, both in providing a history of the creationist movement and in addressing the creationist use of myth and media.

[Caudill's] latest book is something of a disappointment, both in providing a history of the creationist movement and in addressing the creationist use of myth and media.

As a history of the creationist movement, *Intelligently Designed* relates a familiar sequence of events, from the attempts to ban the teaching of evolution in the 1920s, through the attempts to balance the teaching of evolution with the Bible, creation science, or intelligent design from 1973 to 2005, to the ongoing attempts to portray evolution as controversial. Caudill is especially strong on the Scopes trial of 1925, devoting a chapter to comparing and contrasting the iconic figures of William Jennings Bryan and Clarence Darrow, on the political mainstreaming of antievolutionism during the 1980s, and on the inward turn of young-Earth creationism to its own parallel culture in the wake of the Supreme Court's 1987 decision in *Edwards v. Aguillard* that teaching creationism in the public schools is unconstitutional.

Unfortunately, the historical value of the book is compromised by errors and omissions. For example, Caudill consistently misspells the name of the lead plaintiff in *McLean v. Arkansas*, wrongly claims that the Arkansas law overturned in *Epperson* was enacted by the legislature (rather than by initiative), and mistakenly asserts that the Creation Research Society was involved in the publication of a book from the American Scientific Affiliation. While devoting a section to *Alleged*, a creationist film about the Scopes trial, he makes no mention of *Expelled*, a creationist film that, unlike *Alleged*, won a national theatrical release and significant publicity. While devoting a section to the antievolution effort in Kansas in 2005, which resulted in a transient defeat for evolution in the state standards, he makes no mention of the similar and historically continuous antievolution effort in Kansas in 1998.

When Caudill discusses creationist myths, he is not addressing the persistent misrepresentations and misconceptions that circulate in creationist circles, like the idea that Darwin recanted evolution on his deathbed or the idea that there are no transitional forms to be found in the fossil record. Rather, he is addressing social themes that reflect values and structure thought. Caudill identifies four myths with special resonance for the creationist movement: "the garden, the frontier, progress and science, individualism and egalitarianism" (11). But while it is plausible enough for him to observe, for example, that creationists like to portray themselves as rebels, mavericks, and underdogs, thus invoking the frontier myth, the observation is inert in the book. It is perhaps significant that these myths are explicitly discussed in only two passages in *Intelligently Designed*.

Caudill repeatedly pauses to summarize and assess the media's coverage of the events he discusses. His assessments are generally judicious and frequently insightful. But there is no evidence that there is any underlying methodology. How was it decided which reports to assess? What criteria were used? What steps were taken to ensure that the criteria were applied consistently? Devising and executing a quantitative approach to assessing the media's coverage would have been laborious, perhaps, but it would not have been otherwise difficult, and it would have enabled Caudill not only to provide a rigorous assessment of the reports but also to investigate questions that his impressionistic approach is ill-equipped to investigate. The same is true of his assessments of the effectiveness of creationist responses to mainstream expositions of evolution.

Caudill appeals to poll data, especially from Gallup, to justify his claim that creationists managed, by dint of their use of myth and media, to triumph in the public sphere. But his discussion is not sufficiently critical. He sometimes misconstrues the creationist response in Gallup's polling as a young-Earth creationist response; he ignores the mixture of religious issues with scientific issues in Gallup's questions; and he is apparently unaware of the fact, demonstrated by George Bishop and his colleagues, that adding "don't know" and "not sure" as options reveals substantial ambivalence and uncertainty in public opinion about evolution that is otherwise invisible. Caudill is not wrong to think that creationism enjoys a degree of public acceptance incommensurate with its scientific credibility, but the details are not as straightforward as he seems to think.

Although the book is generally clearly written and organized, it contains distracting repetitions and ambiguities.

Although the book is generally clearly written and organized, it contains distracting repetitions and ambiguities. For example, on p. 110, Caudill writes, "The national press fell prey to its own standards," adding, in the next paragraph, "The press had fallen victim to its own practices and standards." On p. 43, he misstates the date and provisions of a Tennessee law, and yet he correctly states them on p. 65. On p. 102, Rick Santorum is said to have "withdrawn affiliation with a Christian rights law center that defended the Dover schools policy"; in the next sentence, he is said "to have been on the advisory board of the Thomas More Law Center, which aided the defense in Dover." The two organizations cited are, in fact, one and the same, but there is no clue for the untutored reader. Flaws like these should have been eliminated at the copyediting stage, if not sooner.

In a bibliographical portion of his book, Caudill reviews the major works on the history of the creationist movement, concluding, "Almost all of these books recognized, or at least alluded to, politics and various media in the history of creationism. None, however, dealt with creationism/intelligent design per se in the press, including the ways in which creationists appealed to the press and how creationists turned the attention into a movement ... There are no cultural histories of creationism as a politicized and mediated twentieth-century movement" (pp. 5–6). Although he succeeded in identifying a genuine lacuna in the literature, his attempt to fill it was, unfortunately, not so successful. Perhaps the greatest value of *Intelligently Designed* will be in its inspiring future scholars to continue the project of understanding the creationist use of myth and media. ■

Glenn Branch is deputy director of the National Center for Science Education, a nonprofit organization that defends the teaching of evolution and climate science. He recently reviewed Jeffrey P. Moran's *American Genesis: The Evolution Controversies from Scopes to Creation Science* for *Evolution: Education and Outreach*.

Bell Witch | Evil Eye | Science vs. Pseudoscience | Murder of a Skeptic | BMI Controversy | Skeptics in Stockholm
Skeptical Inquirer
ISLAMIC CREATIONISM
Harun Yahya's Global Publishing Empire
Dean Radin's Supernormal: Pitfalls and Over-Reaching
When Does Human Life Begin?
Three More Signs of Scientism
Demonology: A Study of What Is Not

When Does Life Begin?

Professor Elie A. Shneour ("When Does a Human Life Begin?" January/ February 2014) has provided a clear statement concerning the continuity of life. Life is a three-billion-year-old continuum. In the various branches of life, descent is a continuous, uninterrupted process in which living cells give rise to living cells. However, he was not able to answer the question he posed: "When does a human life begin?" If we look at any one branch of life we may be able to answer Professor Shneour's question.

When a branch becomes isolated from all other branches a new and unique continuous path of descent is formed. Since this new branch begins with isolation of the branch, a life for any member of the new branch begins with the origin of the branch (since descent is uninterrupted). Each individual in the branch can be traced back in a continuous path to the origin of the branch. For humans this suggests that a human life began tens of thousands if not hundreds of thousands years ago. Just think where you would be if your great-great-grandparents didn't have kids.

Obviously no religious or political group will like this line of thought because if it is true they will have to produce a new set of rationalizations concerning the fate of all members of the continuous line of descent—egg, sperm, child, and adult.

Paul W. Sciulli
Department of
Anthropology
Ohio State University
Columbus, Ohio

The article by Elie Shneour addresses only part of the question. Sure, a fetus is human and alive *biologically*. But the dispute over abortion is on what should be the definition of "human life" morally and legally. These need not be the same as a biological definition.

Edgar Pearlstein
Lincoln, Nebraska

Dr. Elie Shneour's article "When Does a Human Life Begin?" strives to show that the answer is ambiguous. Ambiguity is necessary to support abortion. Saying "Maybe the embryo isn't alive," makes destroying it less difficult. He neglects to mention that at conception, the zygote contains all the substance, all the genes necessary to grow into a unique human being.

He describes the human fetus at three months as less than four inches long and weighing less than two ounces. He says this is "a very long way from being recognizable . . ." as a "human baby" with "no chance whatsoever of leading a life independent of the womb." Interestingly, the fetal heart, a core part of a human, starts beating as soon as twenty-two days after conception. The fetus develops in the protective environment of the mother's uterus. So does its location in the womb make it less alive? The same thirty-week fetus might live inside or outside the mother's womb. A newborn infant is not recognizable as the full-grown adult it has the potential to develop into, nor is it able to lead an independent life. It needs caring parents to grow up.

Dr. Shneour concludes by stating "nature remains the final arbiter of life and death." I agree. We should nurture life and not presume to be its arbiters.

Thomas R. Palmer, MD
Plymouth, Michigan

In spite of the title his article, "When Does a Human Life Begin," Dr. Shneour appears not to distinguish between the origin of life in general and *a* (i.e., individual) human life. I suggest his mention of the time of first appearance on Earth of life that evolved to become human is irrelevant to the question. The earliest moment *a* human can possibly be considered to exist is at fertilization of an ovum by a sperm because neither can, alone, develop any further toward becoming *a* human.

Ken Brownlie
Western Australia
Australia

I agree with Dr. Shneour's assertion that knowing when a human life begins is essential to deciding what Constitutional rights apply to that individual then and thereafter. I disagree, however, that the beginning of human life is so uncertain. Clearly the first of many stages of human life, both in utero and after birth, begins at conception when the egg and sperm unite to form a uniquely human zygote.

Settling the question of when human life begins doesn't resolve the differences surrounding the *Roe v. Wade* decision, but it does sharpen the focus on the real issue, "What Constitutional rights do humans have at every stage of human development?" Clearly, these rights are not uniformly granted, and some are age related. A fifteen-year-old young adult, for example, does not have the right to vote or the authority to enter into a binding legal contract on his own behalf. Those serving in the military do not have the same freedoms of speech that civilians enjoy. Some of our states have the right to take the life of certain convicted felons. Moreover, the human rights of one individual must often be balanced against the rights of one or more other individuals. In the case of a family, the mother, the father, the child, and the state all have individual rights that, at times, are in conflict. Ignoring certain phases of human development will not bring us any closer to a resolution of the debate surrounding the *Roe v. Wade* decision and the protection of women's rights.

Bill Benson
Los Gatos, California

What exactly is a human being? Life begins when the newborn child starts to breathe and the umbilical cord no longer functions. Before that magical moment it is still a fetus. For thousands of years this has been the rule and still is the rule in most societies. If the newborn does not breathe it is called a "still birth" and is not counted as a human birth. All religions accept this fact, and "still births" were quietly buried and forgotten, while newborns who did breathe but survived just a short time were recognized by the church and society as human beings and were given a proper burial.

As Dr. Shneour ably points out, a bird's egg is not a bird. It is only potentially a bird, and there are formidable hurdles to overcome before the human fetus becomes a human being.

John J. Fulford
Long Beach, California

Signs of Scientism

Susan Haack ("Six Signs of Scientism," November/December 2013 and January/February 2014) has invented a form of psychosis that afflicts those of us who do not equate the work of scientists with the work of artists, novelists, economists, and so on. And she has named this affliction scientism. I think she has the issue backward. What we are seeing is not the degradation by scientists of the efforts of these folks but rather the inability of these pseudoscientists to accept the fact that their work is, indeed, not science.

When Haack claims that imagination is the essential spark to progress in all fields of human endeavor and therefore, all fields are equal in value, she ignores a most important point. Namely the constraint imposed on scientists by the laws of physics. For example, no scientist would spend a second looking at a proposed perpetual motion device because he knows the laws of thermodynamics prohibit such machines. Economists, however, argue endlessly about competing economic models, some of which promise perpetual growth in capital, assets, and/or debt. Just change the oxymoron social sciences to social studies and the issue dies.

Mark R. Dusbabek
La Quinta, California

Social studies do not qualify as science. Trying to use the scientific method in an area that is not science produces farcical results. Maybe that is what scientism is.

Kathleen Moran
Fontana, Wisconsin

Susan Haack sets up a series of six straw men that she labels "signs of scientism" then proceeds to demolish them. It made for a long article with little substance.

The "scientisms" that I encounter are not uttered by scientists, but by conspiracy theorists and hucksters of nutritional supplements, quack cures, and alternative medicine.

Harvey Williams
Victoria, British Columbia
Canada

Susan Haack replies:

Disappointingly, none of these correspondents seems to have understood my main theme, even though I stated it, I thought, unmistakably clearly: the need to distinguish giving the achievements of the sciences the respect they deserve from being uncritically deferential to science.

Mr. Dusbabek apparently didn't notice that I said very firmly at the outset: "Science is a good thing"; nor, apparently, that after I said that science, like literature, requires imagination, far from "equating" the two, I said quite explicitly that there are important differences between them. Indeed, an entire chapter of my Defending Science—Within Reason *(2003) was devoted to spelling this out. And while, to be sure, there are also significant differences between the natural and the social sciences (to which I devoted another entire chapter), these were not the subject of this article.*

Ms. Moran asserts that "social studies" don't qualify as science; but she doesn't tell us what criterion she uses to draw the line between science and other things. And, she goes on, using the scientific method in an area that isn't science is liable to produce "farcical" results; but she doesn't tell us what she takes this "scientific method" to be. Perhaps she didn't notice that the third of my "Six Signs of Scientism" was preoccupation with the problem of demarcation, and the fourth, the search for a supposed method used by all scientists and only by scientists, and explaining the successes of the sciences.

Mr. Williams seems to think I said that scientism is something of which only scientists are guilty, which I most certainly did not; and to have missed the second of my "Six Signs": inappropriately borrowed scientific trappings—which, surely, are the stock-in-trade of purveyors of quack cures and such.

Crossed the Line?

"Like religion, alternative medicine relies on the gullibility of its clients, who have been educated to believe without evidence and explanation." Harriet Hall (Reviews, January/February 2014) needs to read Skeptical Inquirer. A mere ten pages before Hall's bigoted comment is the second part of Susan Haack's article discussing the difference between science and scientism. Hall fits into two of Haack's categories: looking to science for answers to questions beyond its scope, and denigrating the worth of other kinds of inquiry besides the scientific.

I realized when I subscribed to SI that I would be seeing a materialistic worldview at the expense of the spiritual. But there is a line between materialism and atheism, and Hall didn't just cross it, she took a flying leap. It's one thing to question whether snake oil can cure the common cold, and another entirely to take as a given the nonexistence of God. The snake oil claim is falsifiable; the existence of God is not. The discussion of the existence of God belongs not in the arena of science but of philosophy and theology, neither of which is or should be the purview of SI.

In the few months I have been reading SI I have been largely impressed with the professionalism of the material presented. But to publish an off-hand and unnecessary insult, and even worse to make it into a pull quote, should be below your standards.

Dave Rich
President, Geotech
Computer Systems, Inc.
Centennial, Colorado

Harriet Hall replies:

Mr. Rich has committed a classic "straw man" logical fallacy: he criticizes me for something I never said. Instead he criticizes something he chose to imagine I meant. Nowhere did I claim (or even suggest) that God doesn't exist or that science can tackle the question of God's existence. The statement he objects to is a paraphrase of what Bunge says in his book:

"[The traditional Chinese medic] won't offer evidence of any sort, nor could he, given that he does not know what Yang, Yin, or Qi are, nor how they could be experimentally wiggled and measured. . . . [he] does not expect his patients to ask such questions, any more than a Christian priest expects his parishioners to ask for evidence for resurrection. Both rely on the gullibility of their clients, who have been educated to believe without evidence and without explanation."

Bunge is a philosopher who is well aware that his own discipline relies on "other kinds of inquiry" that yield meaning and have value but that are not reliable guides to truth for the kind of factual claims that can be tested with science. Science can't prove that God or qi don't exist. Unfalsifiable faith-based beliefs are outside the purview of science and SI, but any falsifiable claim that can be tested is fair game. Science can investigate whether the Earth existed before 4004 BC, whether a statue is weeping blood, or whether intercessory prayer improves outcomes in illness. That is science, not scientism.

Reducing Emissions Profitably

Thomas R. Casten's commentary "Reduce Greenhouse Emissions and Make a Profit . . ." (January/February 2014) was most inter-

esting, particularly because he has spent much of his life working on increasing efficiency in the production of heat and energy while reducing waste. Unfortunately, he reports that fuel and utility companies have resisted efforts in this direction and progress has been minimal. They seem to be focused more on encouraging efficiency at the consumer end of the electric line, urging or requiring consumers to purchase more efficient light bulbs and appliances.

There appears to be less attention paid to what goes on between the production and consumer ends of the line—the transmission of electricity. Although there has been technological advance in the development of a national grid, there appears to be little change in the aboveground strings of utility poles and power lines in the past century. These are so vulnerable to damage from wind and ice storms that the TV forecasters can predict where outages are likely to occur.

How can electrical power be transmitted most reliably, economically, and attractively? Perhaps our government should provide grants to pay the added cost of underground power transmission where feasible and provide research grants for finding and developing new systems of electrical power transmission to replace our anachronistic aboveground system of poles and wires.

David W. Briggs, PhD
Marion, Massachusetts

I applaud Thomas Casten's efforts to increase efficiency in power production and reduce greenhouse gases, but I am skeptical of his appeals to a "free" market (no government regulation) to produce further efficiency gains. Regulations that reduce pollution and promote safety will admittedly often reduce efficiency. However, regulatory costs reduce use and encourage the development and use of renewable technologies (solar, wind, water, and biomass), and conservation.

Moreover, the "no government regulation" definition of a free market is inconsistent with the economist's definition of a free market, which is one with no transaction costs, no externalities, and so on. The economist's free market is optimally efficient given an appropriate definition of efficiency. Unfortunately, this free market is like its cousin in thermodynamics, the free lunch, in that it is a state that does not, and cannot, exist in the real world. However, it does provide a guide to how to produce an efficient market. To whit, regulations that provide information about energy costs (Energy Star) require the incorporation of the costs of externalities (a carbon tax and pollution limits), and reduce barriers to entry for renewables and technologies that improve efficiency (tax credits and subsidies).

In short, I suggest that what we really need is smarter regulation, not no regulation.

Robert Clear
Berkeley, California

"Green" energy companies may indeed make a profit on "green" energy mandates, but to argue that "green" energy is cheaper in a free market is, simply put, a lie—at least right now.

Casten argues that a free market requires: freedom of entry, freedom of exit, accurate price signals, and costs that include the costs of externalities imposed by production. The last is where the lie creeps in, because such "externalities" are 1) highly subjective; and, 2) unenforceable except by governmental decree—the very opposite of a free market. The National Academy's report assigns costs to the usual suspects: climate change and air pollution, but the costs are based entirely upon their own estimates (page 4). This is not to say that the authors didn't do their best to make fair estimates, but their estimates are all subject to argument and, in any case, are not legally binding even now, much less under a "free market."

In a free market, the only relevant costs are those that must be paid. For example, I might argue that wind turbines are so annoying that they impose an annoyance cost on me of a trillion dollars per kilowatt-hour . . . but that's not a legitimate externality unless I am a dictator capable of imposing it (which would, again, put us outside the domain of the free market). In general, my "cost"—however estimated—cannot be imposed and, hence, is not part of a free market, except for whatever individual purchase decisions I might make. Bottom line: the only "externality" costs that can be imposed are via lawsuits and those are, indeed, taken into account by power companies and are relatively small.

In brief, at the current state of the technology, the only way to make "green" energy cost competitive is to, by coercive fiat, impose large extra costs on other forms of energy. That can certainly be done, but the "free market" it is not.

Joel S. Davis
Albuquerque, New Mexico

The Fox News Correlation

While I intuitively believe what you wrote about the Fox News Effect ("The Fox News Effect: Media Use and Global Warming Denial," November/December 2013), I do have a question about the way it was stated. My first reaction was that the article was making causal statements based on correlational data, and I think that this is a common error seen in the presentation of research results in summaries for the popular media. (Does Fox News cause you to think in this way or do people who already think in this way watch Fox News?) However, I sought out the original and found that they use structural equation modeling (SEM). I realize that, in some cases, SEM is used to make causal statements, but it is beyond my understanding of statistics.

I suggest a topic for a future article. From time to time, psychology teachers get on a "today's example of causal statements from correlational data" kick. I think that the cause vs. correlation idea is something that all skeptics should think about automatically when hearing science claims (especially in the media). Perhaps you could write an article about the media claims and how to differentiate between correlational and causal claims. I would be especially interested in knowing more about the way that SEM is used to make cause and effect statements.

Rick Stevens
School of Behavioral and Social Sciences
University of Louisiana at Monroe
Monroe, Louisiana

Illustrating Demonology

In the "Demonology" article (January/February 2014), the illustration on the right of p. 49 should be captioned "Beelzebub," not "Beezlebub," but how about "Beelzebu*g*" or even "Beetlebug"? It doesn't appear to be a beetle (insect or VW) but who's looking? And as far as the illustration on the left of p. 50 goes, the *domovoi* is clearly an escapee from the island *Where the Wild Things Are*, "Boris Zabirozhnik" being a not-very-cleverly encoded, encrypted, and enciphered anagram of "Maurice Sendak." I cracked it in only two hours, and I'm a mediocre cryptanalyst and numerologist. So for you it's off to bed without your supper.

Howard J. Wilk
Philadelphia, Pennsylvania

Anti-Superstition Law Illusory

Being a denizen of the same state in India as the anti-superstition advocate Dr. Dabholkar, I deeply regret his assassination (Special Report, January/February 2014). My issue arises because of the implied pride with which the Anti-Superstition Law is projected by SI and his followers.

The law was passed a short time ago (just after his killing, the government in a typical knee-jerk reaction, passed an anti-democratic ordinance) in the State Legislature Assembly session in my own city of Nagpur. The "fight" against superstition is ill served by such a measure. It can but be an illusory palliative, especially in a country whose judicial system sees the most serious breaches of law not resolved for decades, and that includes those involving rape, murder, communal rioting, and terrorism.

Unless a skeptic has a comprehensive and consistent stand on all aspects of life, their skepticism rings hollow. I wish SI would consider articles establishing this interrelationship and synergy between what would be the logical stand covering theology, all sciences, politics, economics, ethics/morality et al. To avoid conflicts and keep the underlying principles of skepticism inviolate, atheism, evidence-based science, anarcho-capitalism, and Individualism can be the only bedrock. I would welcome a contra-viewpoint from any reader of SI.

Aarmin Banaji
Nagpur, India

Creationism Prevalent, Not 'Mandated'

In his moving tribute to the late Narendra Dabholkar (January/February 2014), Bhaskar Sripada errs in claiming that creation science is "mandated to be taught in schools in Georgia and elsewhere." Such mandates were ruled to be unconstitutional by the Supreme Court in its decision in *Edwards v. Aguillard* (1987). Creation science and intelligent design are, sadly, still taught in schools all over the country; according to a rigorous national study conducted in 2007, about one in eight public high school biology teachers presented creationism as scientifically credible in their classrooms. Although such behavior is also unconstitutional, it is often tolerated and unchecked—confirming Sripada's point that the "mission of distinguishing science from superstition and pseudoscience must be pursued," even in the United States today.

Glenn Branch
National Center for Science Education
Oakland, California

Bhaskar Sripada replies:

I regret the oversight. I should not have written "mandated" but some words to the effect that creation science is tolerated and often unchecked.

Tortoise Mutilations

The review by Stephanie Kemmerer about the animal mutilations on the TV show *The Unexplained Files* (January/February 2014) brings to mind my personal experiences. I am a research assistant with the San Diego Zoo, specializing in the desert tortoise. I work in the Southern Nevada desert and during the course of my workday it is not unusual to encounter tortoise carcasses. Often, they are mutilated. Sometimes, the bodily fluids have been drained. The eyes and tongue, missing. It is not unusual to find only an intact tortoise shell remaining; all limbs, bones and biological parts, gone! As if strategically removed.

Of course, Area 51 is not far, and the desert is a frequent playground for UFOs and aliens. So, it just has to be pesky aliens from outer space mutilating our tortoises in the middle of the night! They have no shame! If the crew and staff on these UFOs were caring and compassionate, they would realize the desert tortoise is a threatened species. The dastardly aliens are sabotaging our efforts to repopulate this species. Drat! Maybe *The Unexplained Files* will do a segment concerning this issue.

Paul Griese
Las Vegas, Nevada

Body Mass Index

Regarding the "Skeptical Inquiree" column "BMI Skeptics" (January/February 2014):

Morbid muscularity being remarkably less common than morbid obesity, BMI retains great predictive value that a given person has an unhealthful degree of body fat. This past week, I have cared for several patients with a BMI > 40. I can assure your readers that in no case was there any risk of mistaking any of them for an NFL footballer.

Had there been such question, another simple clinical tool—a tape measure—could have been used to calculate the Waist:Hip ratio to make the distinction. This latter has the further advantage of predicting health-risk in people whose BMI may be normative.

In brief, if your waist is bigger than your hips (W:H > 1), and you are not pregnant, no matter your BMI or your weight you are likely at increased risk of mortality. Indeed, women with a W:H ratio > 0.8 are, in some studies, at increased health risk.

Gordon M. Verber, MD
San Antonio, Texas

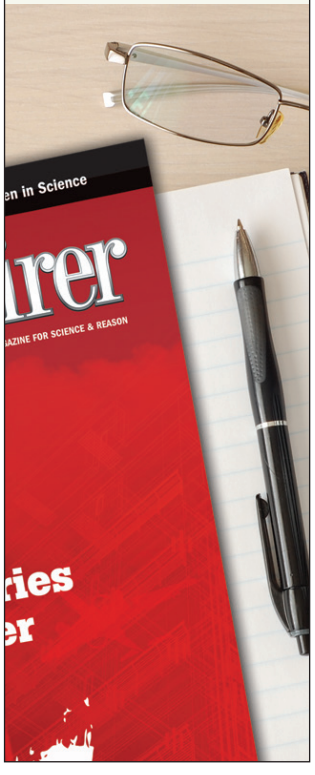
Evil Eye

Massimo Polidoro's fine article on the evil eye lists ways to say "evil eye" in several languages. "Evil eye" in Yiddish is "eyn-oreh"; in Modern Israeli Hebrew it is "ayin ha-ra." Polidoro's "horeh ayin" would appear to be a mistake. (Sources: Modern English-Yiddish Yiddish-English Dictionary by Uriel Weinreich; Hebrew English Dictionary by M. B. Dagut)

Bill Fishman
Los Angeles

[FEEDBACK

The letters column is a forum on matters raised in previous issues. **Letters should be no longer than 225 words.** Due to the volume of letters we receive, not all can be published. Send letters as email text (not attachments) to letters@csicop.org. In the subject line, provide your surname and informative identification, e.g.: "Smith Letter on Jones evolution article." Include your name and address at the end of the letter. You may also mail your letter to the editor to 944 Deer Dr. NE, Albuquerque, NM 87122.

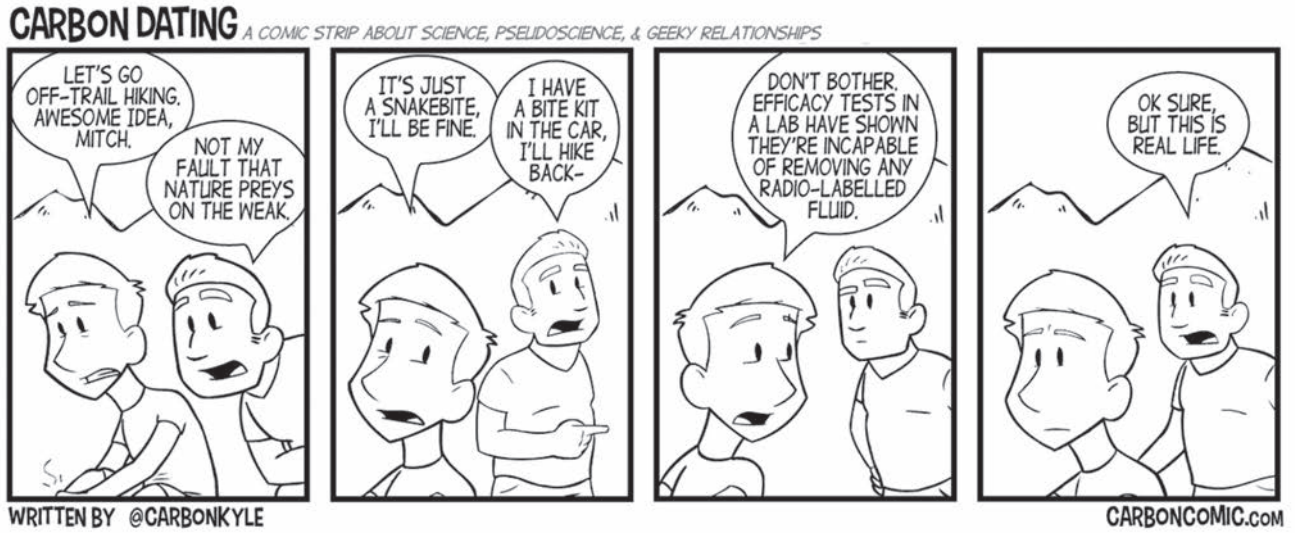


SKEPTICAL ANNIVERSARIES

by Tim Farley

May 7, 2009: A British court ruled against writer Simon Singh over the use of the word *bogus* to describe chiropractic treatments. He later prevailed in his case against the British Chiropractic Association.
May 16, 1994: Asteroid 13123 (1994 KA) was discovered. It was named "Tyson" in honor of Neil deGrasse Tyson, host of the new *Cosmos* television series.
May 28, 2009: Wikipedia banned all Internet addresses and accounts associated with the Church of Scientology from editing on the site. Several critics of Scientology were also banned.
May 29, 1954: The first annual Bilderberg Group conference began; it has since become a continuing obsession for conspiracy theorists.
May 30, 1969: UFO group MUFON was founded as the Midwest UFO Network.
June 7, 1994: U.S. tabloid *Weekly World News* claimed twelve U.S. Senators were space aliens; Wyoming Senator Alan K. Simpson responded, "We've got only one thing to say: Klaatu barada nikto."
June 8, 1984: The movie *Ghostbusters* premiered, providing inspiration for an entire generation of paranormal investigators (some of whom don't seem to realize it was fiction).
June 12, 1989: Writer Paul Brodeur's article on power lines in *The New Yorker* began years of fear mongering over electromagnetic fields.
June 28, 1974: *Nature* published the first paper that linked chlorofluorocarbons (CFCs) with depletion of the Earth's ozone layer.

Tim Farley is the creator of the website whatstheharm.net and blogs at skeptools.com. He is a past fellow of the James Randi Educational Foundation.


CARBON DATING
A COMIC STRIP ABOUT SCIENCE, PSEUDOSCIENCE, & GEEKY RELATIONSHIPS
LET'S GO OFF-TRAIL HIKING. AWESOME IDEA, MITCH.
NOT MY FAULT THAT NATURE PREYS ON THE WEAK.
IT'S JUST A SNAKEBITE, I'LL BE FINE.
I HAVE A BITE KIT IN THE CAR, I'LL HIKE BACK-
DON'T BOTHER. EFFICACY TESTS IN A LAB HAVE SHOWN THEY'RE INCAPABLE OF REMOVING ANY RADIO-LABELLED FLUID.
OK SURE, BUT THIS IS REAL LIFE.
WRITTEN BY @CARBONKYLE
CARBONCOMIC.COM

MYSTERY SOLVED
THE COLONEL
KENSINGTON
INCREDIBLE, AREN'T THEY, KENSINGTON?
THE PEOPLE WHO SHAPED THESE MEGALITHS MUST HAVE HAD EXTRAORDINARY IMAGINATIONS.
DID YOU JUST SAY THAT PEOPLE DID THIS?
MILO KATSOPOLIS
YES...?
DON'T YOU KNOW ABOUT THE ANTEDILUVIAN ASTROMEN?
NOOOO...?
WORDS: ZACK KRUSE ART: JIM MILLER COLOR: MATT GROSS
VISIT: MYSTERYSOLVEDCOMIC.COM

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